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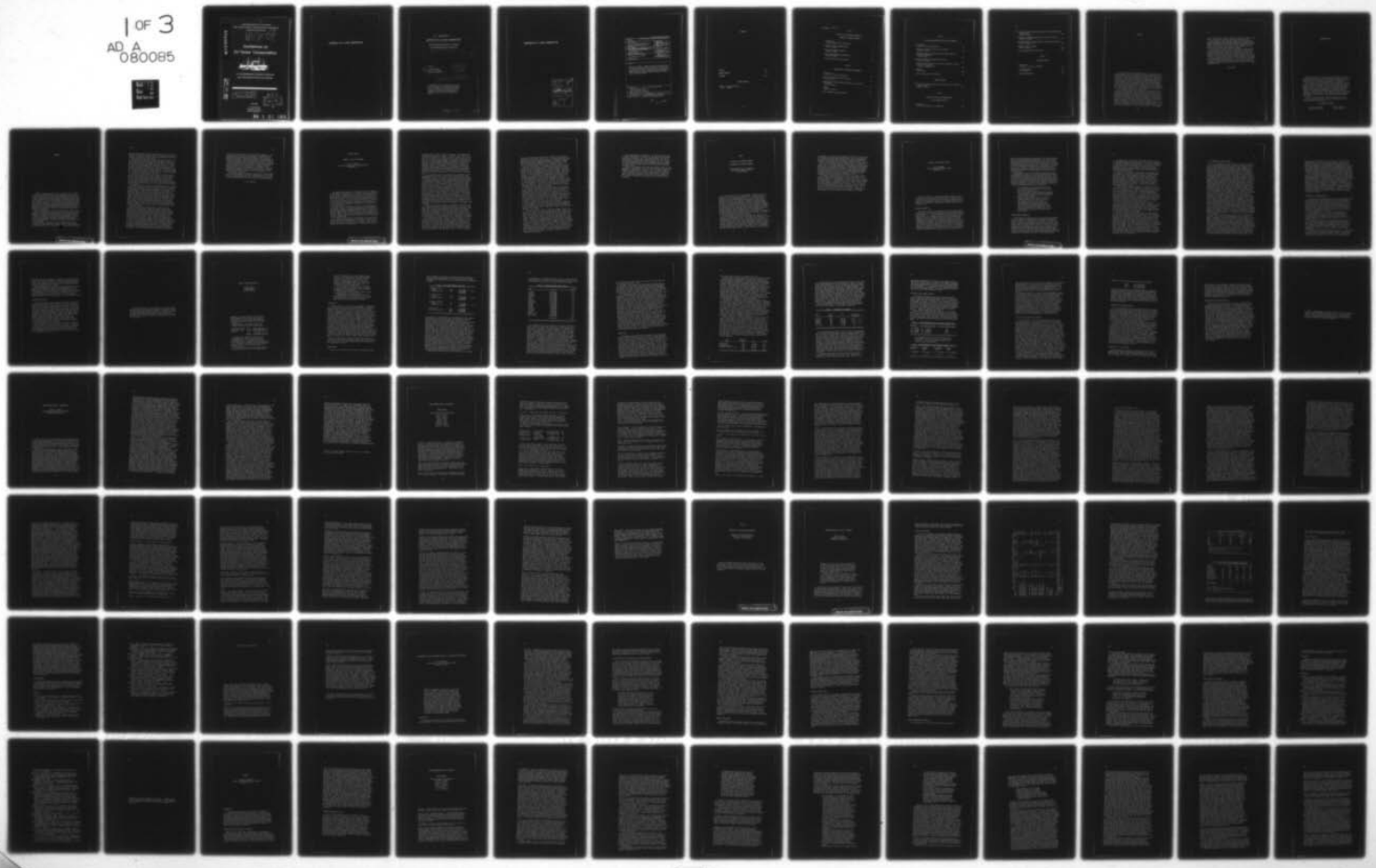

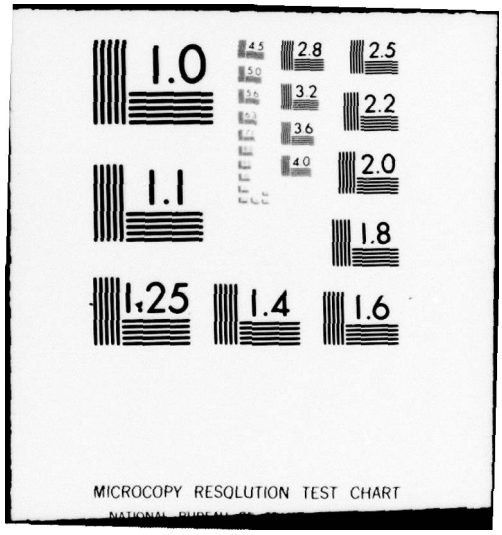
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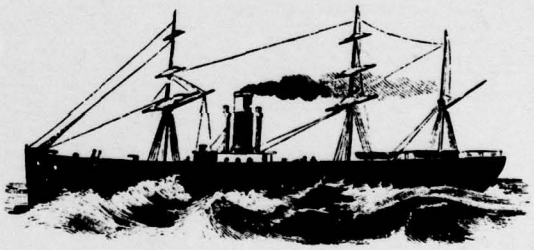

An Interdisciplinary Analysis of National and International Policy and Practice

EDITORS

F. John Vernberg
Ernest B. Altekruse
Shirley Oakes Butler

CONFERENCE ON OIL TANKER TRANSPORTATION

(1) PROCEEDINGS OF

CONFERENCE ON OIL TANKER TRANSPORTATION:

AN INTERDISCIPLINARY ANALYSIS OF NATIONAL AND INTERNATIONAL POLICY AND PRACTICE

Held at Georgetown, South Carolina on 8-10 November 1978,

Editors

(10) *F. John Vernberg,*
Ernest B. Altekruse
Shirley Oakes Butler

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CONFERENCE ON OIL TANKER TRANSPORTATION

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16. Abstract

This volume is the product of a symposium co-sponsored by the Baruch Institute, University of South Carolina, and the U. S. Department of Transportation, held at Hobcaw Barony, Georgetown, South Carolina, Nov. 8-10, 1978. The objective of the symposium was to review, analyze and discuss recent developments in the transportation of oil by tankers. Independent tanker owners, other foreign and domestic merchant shipping interests, various federal and state governmental agencies, environmental organizations, acadaemia, economists, and the marine insurance industry were represented.

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PREFACE

In order to review recent developments in various phases of oil tanker transportation, participants covering a broad spectrum of involvement in this topic assembled in November 1978 at the Hobcaw Barony, the home of the late Bernard M. Baruch, for a three-day conference. Among those represented were independent tanker owners and other domestic and foreign merchant shipping interests, the marine insurance industry, various federal and state governmental units, international and admiralty lawyers, environmental groups, scientists, economists and numerous universities. The program for this symposium was developed and coordinated by Dr. E. B. Altekruse, Dr. Shirley Oakes Butler, Dr. F. John Vernberg and Rear Admiral Sidney A. Wallace, United States Coast Guard.

In the immediate wake of the conference occurred several significant marine disasters involving tankers and oil barges. The groundings and rammings in the Hell Gate Area of the East River and the Mississippi River near Avondale preoccupied the U. S. Coast Guard in late November. The *Esso Bernicia* spilled 310,000 gallons of bunker C off the Shetland Islands in December. The last day of the year, beset by heavy seas, the Greek supertanker *Andros Patria* spewed an estimated 15.3 million gallons of crude oil into the stormy North Atlantic 30 miles off Spain's northwest coast. A week later, two explosions cut in two the French tanker, *Betelgeuse*, as the ship was unloading at the Bantry Bay terminal on the southwest

coast of County Cork, Ireland. Forty-one crewmen, two aides of the owners, and seven local workers were killed in the accident.

On the economic front, the early months of 1979 witnessed the Iranian upheaval with the consequent dislocation of Persian Gulf supplies. The glut of surplus tanker tonnage continued and a sharp rise in OPEC base prices, the imposition of surcharges by certain members of the cartel, and record spot market payments for low-sulphur crude affected former industry patterns.

The relevance of these events to the matters discussed by the Baruch Conference appears striking to the Editors. Additionally, the broad jurisdictional debate and frequent disparity of views between Federal and State approaches to pollution problems have persisted. Many of the particular economic, political and cultural bases of the policy differences and an understanding of the variety of proposed solutions were clarified by the dialogue and exchanges at this interdisciplinary gathering. We trust that the materials collected in these proceedings will also provide the reader with heightened insights into the past and future problems of Oil Tanker Transportation.

THE EDITORS

ACKNOWLEDGMENTS

Financial support from the United States Department of Transportation and the Belle W. Baruch Institute for Marine Biology and Coastal Research, University of South Carolina, enabled both the Conference to be held and the proceedings to be published.

The organizers of this Conference express appreciation for the support rendered by the American Society of International Law and its executive vice-president and executive director, Ambassador Seymour J. Rubin. The efforts of LCDR John Busavage, Ms. Donna Z. Mirkes and Ms. Susan H. Stoeppelwerth in arranging conference logistics are gratefully acknowledged. The Conference was recorded in its entirety by Ms. Susan Dugan, Department of Media Arts, University of South Carolina. Mrs. Rosemarie M. Gunter prepared the typescript for publication. Ms. Mirkes provided editorial assistance.

Special thanks are due the Clemson University and University of South Carolina staffs resident in Georgetown for their cooperation and warm hospitality.

CONFERENCE ORGANIZERS:

Ernest B. Altekruse
Shirley Oakes Butler
Sidney A. Wallace
F. John Vernberg

FOREWORD

Welcome to the Hobcaw Barony, the 17,500 acre vacation site of the late Mr. Bernard M. Baruch and his daughter Belle. The Belle W. Baruch Institute for Marine Biology and Coastal Research, University of South Carolina, is particularly pleased to serve as host to this symposium which brings together outstanding leaders in the various phases of the oil tanker industry and the numerous related areas which it influences. It is fitting to have this august group meet in Hobcaw House as Mr. Bernard Baruch entertained many world leaders here, including President Franklin Delano Roosevelt and Prime Minister Sir Winston Churchill. To appreciate the origin and nature of our Institute, a few brief historical and introductory comments are presented.

Belle Baruch's father, Bernard M. Baruch, was a native of South Carolina. Although he left the state as a child and became known worldwide as a financial leader and advisor to presidents, he retained a life-long love for the State's coastal region. Early in the 1900's he purchased 17,500 acres bordering Winyah Bay, North Inlet, and the Atlantic Ocean near Georgetown. This land was called the Hobcaw Barony. "Hobcaw" is an Indian word meaning "between the waters".

Great historic significance can be attached to the Barony. Presumably, an early Spanish settlement, San Miguel de Gualdape, was located here in 1526. Later, during colonial times, the King's

Highway, which extended north from Charleston, bisected the property and remnants of a colonial fort and a colonial cemetery are in evidence. A twentieth century addition is Hobcaw House. Here Mr. Baruch entertained many world leaders.

Belle Baruch was the eldest of the three Baruch children, the one who most loved Hobcaw, and eventually Mr. Baruch gave all of Hobcaw Barony to her. Belle Baruch was well aware of the uniqueness of this unspoiled environment and the potential of the area for research and development of conservation practices. In time she drew up plans for a Foundation to foster the development of research programs in marine biology, forestry, and wildlife science by colleges and universities in South Carolina. Since Belle Baruch was so devoted to her land and South Carolina, it was only fitting tha' the Foundation should carry her name.

The Belle W. Baruch Institute for Marine Biology and Coastal Research was started in 1969, jointly funded by a grant from the Belle W. Baruch Foundation and the University of South Carolina. We now have more than forty faculty associates, representing biology, geology, engineering, chemistry, archeology, economics, international studies, and law. At present fifty graduate students and two hundred undergraduate majors are working on various marine-related projects.

The Hobcaw Barony is located near Georgetown, south of the Grand Strand resort area which extends from Pawley's Island to the North Carolina line with Myrtle Beach near its midpoint. The plantation is approximately 45 miles north of Charleston. Winyah Bay, a low-salinity estuary, forms the western boundary, and the Altantic Ocean, the eastern boundary. On the Baruch property, and of particular interest to us, is North Inlet Estuary. Although it interconnects with Winyah Bay, there is little exchange between the two regions, and the North Inlet Estuary tends to be relatively isolated. This estuary is particularly suited for ecological study since there are no developments along the shore, and the Belle W. Baruch Foundation plans to preserve this property for long-term estuarine studies. Thus, here is a relatively undisturbed estuary that can be studied on a long-term basis, a rarity along the coast of the United States.

Associated with the marine waters are a rich variety of habitats. The approximately 6,500 acres include salt marshes, sandy bottoms, mud bottoms, sand-shell bottoms, protected intertidal zone and beaches and open beaches; oyster reefs are abundant. At present our research facilities at the coast consist of a laboratory building, various small boats, field equipment, a boat house, and the Kimbel Center, which consists of cottages and a meeting-recreation building. Hobcaw House, which has excellent facilities for seminars and symposia, is our principal meeting site.

One of our chief research objectives is to develop a model of an estuarine ecosystem based principally on the North Inlet Estuary, since this unexploited estuary is available for extended studies. At present various staff members, both here and at neighboring institutions, are working cooperatively on various components of the estuary. This coordinated study includes primary productivity

studies on both the aquatic and the terrestrial components. Secondary production studies of zooplankton, the meiofauna, macroinvertebrates, and vertebrates are underway. Physical oceanographers, geologists, chemists, and biologists are analyzing the physical environment. Also, systems analysts are working with us to develop a predictive model of estuarine processes. In addition to the overall objective of the analysis of an estuarine ecosystem, each staff member and his students have a number of individual projects with which they are involved. To complement these scientific endeavors, an interdisciplinary approach to analyzing environmental problems exists in the Institute which blends the expertise of economists, lawyers, political scientists, and the so-called "hard" scientists.

By bringing together this group of experts with widely ranging areas of specialization to discuss a central theme, I am sure the results of this symposium will have far-reaching impacts not only to the participants, but also to the readers of this proceedings.

F. John Vernberg

KEYNOTE ADDRESS

TANKERS: TODAY AND TOMORROW

Alan A. Butchman
United States Department of Transportation
Washington, D. C.

Dr. Vernberg, Mrs. Butler, ladies and gentlemen. On behalf of the Department of Transportation, I welcome you to this conference on "Oil Tanker Transportation." As you know, the Department is co-sponsoring the conference with the University of South Carolina. The University has provided us with ideal surroundings for a conference of this sort. I am sure that your sessions at Hobcaw Barony tomorrow and Friday will be successful, at least in part due to the character and ambiance of the premises for the meeting. I am only sorry that my commitments elsewhere will preclude my personal participation.

A special note of thanks is due Dr. Ernest Altekruse who has played such a key role in making arrangements for the conference. His boundless energy and dogged perseverance have enabled him to overcome many obstacles in getting us all together. He truly has been the catalyst that turned the concept of the conference into a reality. Thanks, Ernie, from the Department of Transportation and, if I may speak for them, from your associates here who found your services indispensable.

So, we have an ideal place to meet and we have an exceptional group of people who are prepared to participate. The list of attendees is truly interdisciplinary in character, and the conference is structured to encourage a free exchange of views on most aspects of oil tanker transportation. In my view, each of you is

an opinion maker in your own field of endeavor, be it industry, the environmental movement, government, or academia. Each will have a chance in the next day and a half to inform, to learn, and to affect the views of others. Such a process can only yield constructive results. We, the conference sponsors, are confident that we have the right mix of people brought together in the proper circumstances to deal with a very complex set of related subjects. We urge you to question, to argue, to participate fully - and thus to share our conference purpose. That purpose: to achieve new perspectives on and better understanding of the perplexing problems of oil tanker transportation. Certainly in government we need to comprehend the economic, environmental, social, and managerial aspects of tanker operations far better than we do now. Help us do that in these two days.

I have personally been deeply involved, since President Carter's Administration took office, in problems that relate to the marine transportation of oil. You will all recall the President's message to Congress of March 1977 in which he described measures to be taken by the Executive Branch and made recommendations to the Congress and the international community. Brock Adams, our Secretary of Transportation, took an active personal role in implementing the President's program. In May of 1977 he visited London for the express purpose of presenting the U.S. proposals for international action to the Council of the Intergovernmental Maritime Consultative Organization - "IMCO". The Secretary instructed me to participate actively in the negotations that followed and to work closely with the Coast Guard on the domestic aspects of the President's initiatives. In that capacity, I served as Head of our delegation to the October IMCO meeting, preparing for the International Conference on Tanker Safety and Pollution Prevention, and as U.S. Representative to the Conference itself, held in February of this year. I make this point to emphasize that the political leadership of the Department has not only been intensely interested but has participated actively in implementing our government's policies with respect to oil tanker transportation.

I must, at this point, recognize the immense contributions made by the United States Coast Guard in these efforts. The unique technical competence and solid professionalism demonstrated by the Coast Guard team constituted the ingredients of success at the February conference. The captain of that team, Rear Admiral Mike Benkert, is here in his new capacity as the President of the American Institute of Merchant Shipping. I am sure Mike's participation, and his unmatched style, will add immeasurably to the conference proceedings.

Turning now to the subject matter of the conference, I would like to pose a few questions about "tankers, today and tomorrow," that must be addressed in one way or another in your discussions. These questions, all troublesome and many unanswerable at this stage, are not rhetorical. Rather, they are fundamental, depicting problems that require the concentrated efforts of disparate interests if solutions are to be found. At the least, their consideration at this conference is likely to shed some light in dark corners and enhance better understanding of the underlying issues. Critical questions

concern the tanker market today and its prospects in the future. How bad is the so-called "tanker glut"? Is the situation improving? Are measures recently adopted with regard to standards and practices likely to help or hurt shipowners afflicted with excess tonnage? What are the strategic implications for the Western World? What sort of solutions are politically and economically viable?

What about regulation for purposes of safety and environmental protection? Can the results of the February conference be brought quickly into force internationally? The United States is moving resolutely both to implement nationally and to ratify. Will others follow? Do the new international rules go far enough? Some argue that it is time to implement and consolidate the rules already developed. Can this be done if another tanker catastrophe occurs? Does what has been done offer the hope of stability coupled with adequate environmental protection and enhancement of safety?

New standards for construction and equipment and tighter rules for certification have been adopted in the face of threats to safety and the environment. How real are the threats? Do we know enough about the effects of oil pollution to make rational decisions on the proper degree of control? If available information is deemed unconvincing by some, what need be done?

Institutional arrangements to address tanker problems abound. Internationally, IMCO, the LOS Conference, OECD, the European Community, NATO--all these and more tackle parts of the puzzle. In the United States, the Executive Branch, the Congress, even the several States regulate--all subject to litigation as well as political pressures. Non-governmental institutions grapple with parts of the problem, each according to its own lights. Are these institutions working effectively? Are the issues treated fairly, or do special interests prevail at cost to the common goal? Can we afford to continue to act as we have acted in the past?

Higher standards for tankers and crews cost money, ultimately paid by consumers. Do we risk substantial inflationary pressures by raising standards further? What about the risk of implementing those already adopted? Where is the balance between cost and safeguarding social values?

There are a variety of ways in which our country receives its oil, and the future will bring new importing methods. Smaller crude tankers now enter our ports in profusion, most under foreign flag. Oil is trans-shipped through Caribbean ports and is lightered from VLCC's off our shores. Some oil from outer continental shelf activities reaches our refineries through pipelines and more in small tankers. Both means of transportation will grow as OCS activities expand. Pipeline and tankers transport refined products from point to point in the U.S. and 1980 will see a deepwater port in operation, surely to be followed by more of these facilities, designed to take advantage of economies of scale in tankers. Is our standard setting keeping pace with developments? What are the pros and cons of setting standards for OCS tankers that are higher than those applying to ships in foreign trade? In setting standards, how do we reach a proper balance between the needs of commerce and the requirement for protection?

All these questions are important. And many more can and will be posed. Undoubtedly, in the next day and a half you will delve deeply below the surface that I have but scratched. What is important here is that you are willing and able to do so. You cannot solve the real problems in the time alloted, but your exchange of ideas, information, opinions, and sometimes conflicting views will contribute to problem solving as we move ahead in the months and years to come.

Thank you for joining us here and participating in what, to the Department of Transportation at least, is an unusual and distinctive approach to conferencing. I wish you well. And while I hope that on Friday you will part as friends, I urge that your sessions be candid, searching, analytical, and forward looking. I know that what you take away from here, and the conference proceedings itself, will be of enduring value because of your interest and participation.

TOPIC A

THE ROLE OF THE TANKER INDUSTRY IN TRANSPORT OF ENERGY RESOURCES

Shirley Oakes Butler, Chairperson
Westminster Management Company
Nassau, Bahamas

Dr. Shirley Oakes Butler: Good morning. Welcome to the first session of the Baruch Institute--Department of Transportation Conference on Oil Tanker Transportation. Our objective during the next two days is an interdisciplinary analysis of national and international policy and practice in a specific area of maritime commerce. When Secretary Butchman surveyed the assembled company last night, I think he perceived that, if not yet interdisciplined, we were already interrelated, either through an academy, a profession, the maritime industry or perhaps only a mutual feeling for the sea and the seafarer. The announced purpose of this multi-disciplinary gathering--and the major assignment for its participants--is actively and assertively to inter-relate. The quality of interaction we are seeking has been described by Secretary Butchman as "candid, searching, analytical and forward-looking".

We are therefore faced with a unique task and, like the very subject of the symposium, one that is fraught with anomalies, factual uncertainties and misconceptions. For example, this audience is undoubtedly aware that by far the greatest source of ocean pollution is land-based and, from that origin, the larger percentage is air-carried. Nonetheless, in the popular imagination, marine pollution has been equated not with industrial discharges into the atmosphere but with tankers and oil spills. The error may not be surprising in view of the dramatic impact of marine disasters, the specificity

or immediacy of potential coastal damage from spills and the interest of the media in these highly visible events. By the same token, we also know and must deal with the dismal fact that the preponderance of vessel-source marine pollution occurs through intentional discharge of oil residues by way of blowing of ballast and tank cleaning.

We will have to address various economic factors. The United States, one of the largest importers of ocean-borne petroleum, appears either unable or unwilling effectively to cope with the diseconomy of its energy pricing policies and persists in marketing and consuming petroleum at below world price levels. We must grapple with these and many other issues as well as the fundamental questions posed by Secretary Butchman in his keynote address. I believe the group assembled here has the expertise and acumen so to do.

Our opening session deals with the Role of the Tanker Industry in the Transport of Energy Resources. As our first speaker, I am pleased to present Mr. John Dugger who is with the Office of International Affairs of the Department of Energy where he is responsible for oceans policy. He graduated from the U.S. Naval Academy in 1945 and George Washington University Law School in 1970. He has acted for the Defense Department in matters involving the Law of the Sea and, since 1974, has represented U.S. energy interests in both the Law of the Sea and Antarctic Treaty negotiations. Former naval person turned lawyer, he has suffered a further sea change and will be speaking to us today primarily as an economist. Mr. Dugger.

CRUDE OIL AND THE ENERGY CRISIS

John A. Dugger
United States Department of Energy
Washington, D. C.

Thank you, Shirley, In having me replace Dr. Merklein on the program, I note that the word "Interdisciplinary" in the title of the Conference is getting more than its share of emphasis, since a lawyer will be speaking on behalf of an economist, which gives me some extra flexibility in defending any economic aspects of what I am going to say.

NATIONAL ENERGY ACT

This morning, while I am speaking to you, an historic event is taking place, In 15 minutes, President Carter will sign the National Energy Act. We of the Department of Energy are particularly pleased that a U. S. energy bill is at last on the books, even though it does not accomplish everything that the Administration originally set out to achieve. First and foremost, the energy legislation is dedicated to keeping down imports of crude oil. It is designed in the longer run to take best advantage of our scarce energy resources against a mid-term future in which energy prices, as a result of crude oil constraints, are likely to rise substantially, and a longer-term future where we will have to depend on renewable energy sources and nuclear power. Most of us, including toilers in the Department of Energy, have been confused by the

from their controlled levels substantially below the world market price to levels approximating world market. Just after the Congress adjourned, Secretary Schlesinger said that the oil price-tax issue is a major priority for the next congress but said that the Administration has not decided its strategy yet, he called the revival of Crude Oil Equalization Tax a lively option, but would not rule out decontrol, if coupled with an excess profits tax. Under present energy legislation, enacted in 1976, oil price contols expire in 1981, but the President might propose decontrol after May 1979.

The Energy Bill, as it finally passed, was less strong than the Administration advocated, and not as responsive as we might have wished to the desires of other industrial countries, of the producing countries concerned about the rapid depletion of their oil, or of the oil-consuming developing countries who have been suffering most under the new energy situation and which have little near-term alternative to reliance on oil imports. According to Secretary Schlesinger, popular attitudes leading to difficulties in getting through legislation have resulted from:

-- The continuing ability for Americans to obtain all the energy they desired since the gas lines ended in the spring of 1974;
-- The current plentiful supply of energy, domestically and globally, because temporary new supplies from Alaska and the North Sea are out-distancing growth in global demand;
-- Domestic energy policies which have prevented passing through the full impact of rises in real world oil prices to our citizens;
-- The widespread but incorrect belief that a large Research and Development program in solar and other renewable energy sources will quickly eliminate the energy problem. (Depletable energy resources will supply most of our energy needs for the next two decades and probably beyond).

SUPPLY/DEMAND PROJECTIONS

Some experts have declared that our concerns were exaggerated. There are certainly no universally accepted supply/demand projections. There is growing acceptance, however, of the concept that the growth rate in demand will race ahead of the rate of new supply, once world demand absorbs the full production from Alaska and the North Sea around 1980 or thereafter. We believe that the shortage of desired supply will result in price increases in the 1980's which will have highly adverse economic impacts. Domestically, these price rises could sharply increase unemployment and inflation; internationally they could cause financial and political instability and intensify pressures for trade protectionism.

In looking at U. S. and world energy demand, I will call on the analysis published earlier this year in the report to Congress of the Energy Information Administration. U. S. energy consumption, in the shorter term, will go from an historic growth rate of 2.8% per year in 1965-75, to a 1975-85 rate of from 2.4% to 3.2%, depending on overall economic growth. After 1985 the growth of energy consumption would drop to about 2.5% in a high scenario or about 2% in a low scenario.

The growth rate in petroleum consumption will be higher than the average rate, at between 4 and 6% in the low and high growth projection. Natural gas consumption, limited by supply, will decline, while coal demand growth will be at about the same rate as petroleum. The short-term outlook is characterized by growth in domestic oil production, which will virtually offset the short-term decline in gas supply. This is due entirely to increasing deliveries from Alaska. In this analysis, growth rate of total domestic energy supply is likely to be about 1.5% while demand grows at 2.6%.

In the mid-term, further development of Alaskan and OCS oil resources is expected to allow domestic oil production to continue to rise at a modest level at least to 1985, while coal production will increase substantially. With the National Energy Act in place, oil imports may be held down to around 9 MMBD instead of the 11-12 they might otherwise be. The longer term is much more complex and difficult to predict, of course, but to cite from one long-range scenario, designed by Brookhaven National Laboratories, oil and gas consumption will peak in the 1980-90 time frame, and decline to near zero in the second quarter of the next century, with imports also declining rapidly after 1990.

For the shorter term, let me give one scenario based on reasonable projections and assuming the major oil importing nations adopt vigorous and successful energy programs. Assuming constant real OPEC prices and the OECD projection of about 4% economic growth through 1985, the free world demand for oil is projected to increase from 55 MMBD at the end of 1977 to 64-67 MMBD, in 1985. U.S. imports are assumed at 9-10 MMBD.

Oil supply to the free world is projected to grow from the current 52 to 54 MMBD (with Saudi production levels at 8-10 MMBD) to a level of something like 61-63 MMBD in 1985. This would mean OPEC supplying 37-39 MMBD, and other free world supplies around 24 MMBD. This also assumes Soviet Bloc supply and demand are in equilibrium, although in some forecasts the USSR could be a net importer of as much as 2.5 MMBD, or an exporter of up to 1 MMBD. Under this scenario, world-wide demand would begin to be constrained in the early 1980's, and a gap would appear in supply in the early 1980's of 3-8 MMBD. Actually, of course, no gap would appear. Prices would simply go up, with corresponding effects of unemployment, inflation, and balance of payment difficulties. Our major trading partners, worse off than we in their dependence on imported oil, would suffer more, and the consequences for the developing countries could be catastrophic.

U.S. INTERNATIONAL ENERGY STRATEGY

The U.S. international energy strategy to prevent such a bleak future from coming about and one to deal with political hazards of an oil-based economy, has been based on four components. The first is a strong and effective domestic energy program, which I have outlined. The second is industrial country cooperation, exemplified by the International Energy Agency, a 19-nation body which is the central focus of industrialized country coordination in dealing with energy challenges. Last October, IEA countries committed themselves to hold total oil imports of member countries to 26 MMBD by 1985, a goal which if achieved would sharply reduce the possibility of a global supply crunch in the 1980's. The IEA members are working toward this goal through creatively competitive domestic energy programs and through R&D cooperation. The most important IEA activity is of course the emergency sharing program, through which member nations act collectively to meet any future supply disruption. Earlier this year, emergency procedures went through a six week test. Right now, IEA emergency plans are being reexamined in light of the Iranian crisis, in the event that any of the IEA Members largely dependent on Iran for supplies should require the sharing of a constrained supply. Third, we are working with the non-oil producing developing countries, who have the potential for rapid growth in consumption and for substantially increasing the strain on global supplies, to channel their energy growth toward renewable supplies and to encourage them to conserve in the course of their orderly economic development. Fourth, and of the utmost importance, we are working to encourage a smooth and orderly transition period among the oil producing nations. These countries have a heavy responsibility as a result of their possession of a majority of the world's hydrocarbons, and must be prepared to look beyond their own narrow national economic interests. At the same time, they have every right to expect that oil importing nations will undertake effective action in conservation and development of alternative supplies, and they have an interest in making alternative supplies available to themselves when their hydrocarbons start to run out.

Saudi Arabia is critical, with 27% of the free world's total reserves. If it does not expand production from a current 8.5 MMBD to 12 MMBD or more by the mid-1980's, a severe supply crunch may be unavoidable. Yet their need for additional revenues is very limited. Fortunately, since the end of the 1973-74 embargo, the Saudis have repeatedly shown an admirable degree of responsibility; they have been the leaders in moderating OPEC price increases, at times standing virtually alone. They have resisted strong pressures to price oil in terms of a basket of currencies. They have produced consistently at levels above those needed to meet their revenue needs, and they have been strong supporters of U. S. Mideast peace efforts. They have invested their surplus financial assets with care, with concern for international financial stability and for the economic and political sensitivities of other countries. They

have increased substantially their own foreign aid, though the distribution of that aid still remains limited. Finally, they have been a strong voice for moderation and cooperation in the North-South dialogue. To ameliorate future global supply difficulties, Saudi Arabia must undertake major new expenditures to expand productive capacity. The U.S. has been intensifying its bilateral relations with Saudi Arabia with a view to assisting its economic development, enhancing its political influence, and increasing its security, particularly with respect to its legitimate defense needs.

As to other oil-producing nations, we are ready to assist with appropriate financial and technological means other countries whose reserves would permit further expansion of productive capacity and global energy supply. Iraq, Kuwait, and the UAE are in this category. We have also been cultivating our bilateral relationships with Mexico, for a variety of reasons. Although still something of a dark horse, their potential looks substantial, and Mexico could be exporting upwards of 2 MMBD by the mid-1980's. We are looking to other countries like the People's Republic of China, from which the Secretary of Energy just returned Tuesday. Though China may never be a major exporter, help and encouragement from the U. S. may postpone the day that China becomes another consumer competing in the world oil market.

DEVELOPMENT OF NEW TECHNOLOGIES

In looking at world energy supplies, I have talked mostly about hydrocarbons, but the question of what effect the development of new technologies may have on supply and on the future of ocean movement of oil is a very valid one. Unfortunately, most of the new technologies in their current state will deliver energy resources at higher cost than can be delivered using crude oil at today's prices. However, should the price of oil rise rapidly in real terms, alternate fuel sources would tend to be highly competitive if enough can be produced.

Coal constitutes 90% of our fossil fuel reserves, but is only 20% supplier of U. S. energy. Synthetic fuels from coal are not now very appealing, at $25 or so per barrel of crude equivalent for synthetic liquid fuels, and $5.50 per thousand cubic feet for high-BTU gas as compared to $1.93 in the Natural Gas Bill.

There are huge reserves of oil shale--second only to coal in size of resources in the U.S.--but present uncertainties over production costs, markets and environmental restrictions have put a damper on development by the private sector, and much will be needed in government incentives if shale is to provide us a viable option if the cost of more traditional fuels becomes prohibitive.

Light water reactors now provide about 14% of U. S. electricity, and this capacity is expected to double by 1985. At present it takes about 12 years from the decision to build a nuclear plant until it starts producing, and even under the Administration's

licensing bill being considered by Congress it will still take 6.5 years. Nuclear power continues to be beset by problems both here and in other developed countries, and further delays in developing nuclear power capabilities are bound to put increasing demand on future world supplies of oil and gas.

Among renewable resources, solar-energy--including wind, ocean thermal energy conversion, waves, and such--have had a lot of glamor but are requiring a great deal of government help to make them commercial. Even more optimistic forecasts do not expect solar-related technologies to account for more than about 10% of U. S. energy supply by the turn of the century. All of this should lead us to believe in a strong future for oil and gas while they last.

TANKER DEMAND FORECAST

You will note that I have avoided the use of specific numbers in most of what I have said today about the future. Nobody knows better than the owners of large tankers how unforeseen events can make the best forecasters wiser, sadder, and poorer. With so many experts in the field, the Department of Energy does not undertake, on its own, prognosis of tanker demand, but I might share with you a forecast we are currently using for planning, prepared for the Department by Petroleum Economics of London. U.S. tanker demand is expected to grow at about 9% per annum to 1980, then decline slowly at about 2% to 1990. This reflects increased U. S. demand for long-haul liftings to 1980, followed after 1980 by an increase in short-haul liftings and a gradual decline in overall demand after the late 1980's as the stockpile is filled and reliance on imported oil is reduced.

Let me suggest, in closing, that we use the word "crisis" as it appears in the title with a good deal of caution. It implies an event for which a short-term solution is possible. Some speak of an energy "crunch", when supply is overtaken by demand and prices escalate. Whatever you call it, it is a problem sure to have profound effects on the world tanker market and on our lives. It is a challenge for all of us.

Shirley Oakes Butler: Our next speaker is Mr. Erling Naess, Chairman of the International Association of Independent Tanker Owners headquartered in Hamilton, Bermuda. Mr. Naess is a native of Bergen, Norway who has been associated with shipping and specifically the oil tanker industry for many years. His is an important *vox experientiae* and we are fortunate to have him with us. Mr. Naess.

WHAT IS THE TANKER INDUSTRY?

Erling D. Naess
INTERTANKO
Hamilton, Bermuda

ABSTRACT: The tanker industry is the industry which transports across the oceans close to 2 billion tons of oil per annum, thus rendering a service upon which the world today is totally dependent.

The ownership of the world's tankers and combined carriers falls under three headings:

Independently owned	66.6%	250,041,000 tons d.w.
Oil Company owned	26.9%	100,852,000 tons d.w.
Others	6.5%	24,475,000 tons d.w.
	100.0%	375,368,000 tons d.w.

The Republic of Liberia has under its flag the biggest tanker fleet in the world, with 115,368,000 tons d.w., followed by Japan with 35,407,000 tons d.w., Britain with 34,162,000 tons d.w., Norway with 33,972,000, Greece with 20,859,000 tons d.w. and the rest distributed under many different flags.

The average size of the world's tanker fleet is today about 94,000 tons d.w. The largest propor-

tion of the world's fleet is over 120,000 tons d.w. and 67.2%. The tanker fleet of the world consists to the extent of 78.7% of vessels built in 1969 and after. Vessels built up to 1968 are 21.3% equal to about 80 million tons d.w. A great proportion of these vessels will probably have to be scrapped within the next eight years.

The poor state of the industry is reflected in a very large amount of tonnage laid up. On August 1st 1968, it was 44.4 million. Of these were about 58% vessels over 200,000 tons d.w.

The scrapping of tanker tonnage created a record in 1978 with about 15 million tons d.w.

INTERTANKO has been working hard to get rid of substandard tankers. This continues to be a problem but the IMCO protocol of February 1968 will be a great help when it comes into force in 1981.

INTRODUCTION

I shall speak to you as Chairman of INTERTANKO. INTERTANKO is the International Association of Independent Tanker Owners whose members control about 190 million dwt of tankers and combined carriers. This, is close to 51% of the world fleet and close to 76% of the independently owned fleet. What is the tanker industry? It is the industry which transports across the oceans close to 2 billion tons of oil per annum, thus rendering a service upon which our world today is totally dependent. Compared to other kinds of shipping the tanker industry is a young industry. The famous Drake's well in Pennsylvania, generally looked upon as the opening of the modern era in oil, was drilled in 1859. To begin with the oil was transported in casks or drums. In 1869 a sailing vessel by the name of "Charles" was fitted with 59 iron tanks for the carriage of oil but leaks developed and this method was abandoned. It was not until 1884 that the Armstrong Whitworth shipyard in England built the first tanker on modern lines with the shell of the ship itself forming the tank in which the oil was carried. This historic ship was named "Gluckauf" and had a deadweight capacity of 3,000 tons. Today, less than 100 years later, the total deadweight of the world tanker and combined carrier fleet as per July 1st 1978 was 375.4 million dwt, in spite of severe losses during two world wars.

Since the main purpose of this Conference is to discuss the protection of the marine environment, tanker safety and prevention of oil pollution, I will try to analyse the world's tanker fleet with that objective in mind.

TANKER OWNERS

How much of the world's fleet is owned by independent owners,

by oil companies and by others? The main ownership categories of the world tanker and combined carrier fleet as of July 1st 1978, according to H. Clarkson & Co. Ltd.'s July 1978 Review are presented in Table 1.

TABLE 1. MAIN TANKER OWNERSHIP CATEGORIES

Independently owned:			
Tankers	2,093	206,750,000	66.6%
Combined Carriers	377	43,291,000	
		250,041,000	
Oil Company owned:			
Tankers	852	97,825,000	26.9%
Combined Carriers	26	3,027,000	
		100,852,000	
Government & Domestic			
Tankers	620	23,311,000	6.5%
Combined Carriers	15	1,164,000	
		24,475,000	
Total Tankers	3,565	327,886,000	
Total Combined Carriers	418	47,481,000	
	3,983	375,367,000	

The proportion of tankers owned by the independent owners has been declining during the last few years and is now 66.6%. The proportion owned by the oil companies has increased to 26.9% while the proportion owned by governments and operating in protected domestic trades is 6.5%. The oil companies have lately taken advantage of the decline in the market value of tankers to acquire cheap tonnage. The independent tanker owners are the *Marginal* oil transporters. Oil companies first employ their own tankers to satisfy their need for tonnage and only to the extent that there is need for additional tankers do the independent owners come into the picture. They are in that respect in the same position as that of taxi drivers. They cater for the demand for transportation which is in excess of what the private car owners can handle. It is important to keep this in mind when the industry is confronted with the need to spend a lot of money on the fleet to reduce pollution. The low freight rates ruling during most of this year and the firm scrap market has resulted in the unusual situation that a greater tonnage of tankers has been scrapped than delivered. The world fleet is therefore likely to show a decline at the end of 1978 compared with the end of 1977. This decline follows ten years in which there was an average annual increase in the world fleet of 13.6% and only two individual years when the carrying capacity was less than 10% above that for 12 months earlier.

Having observed what proportion of the world's fleet is owned

by independents, oil companies and others, let us see what nationalities we have to deal with. Here is a summary of the world tanker and combined carrier fleet as divided under different flags.

TABLE 2. NATIONALITIES OF TANKER FLEETS

Flag	dwt	Percent
Liberian	115,368,000	30.8
Japanese	35,407,000	9.5
British	34,162,000	9.1
Norwegian	33,972,000	9.1
Greek	20,859,000	5.5
French	16,130,000	4.3
American	13,770,000	3.8
Panamanian	12,592,000	3.3
Italian	12,197,000	3.3
Spanish	9,364,000	2.5
Swedish	7,807,000	2.1
Russian	6,690,000	1.8
W. German	6,469,000	1.7
Singapore	6,169,000	1.6
Danish	5,379,000	1.4
Netherlands	4,009,000	1.0
Other Flags	35,024,000	9.2
	375,367,000	100.0

If the Liberian flag fleet is divided up in accordance with beneficial ownership a substantial proportion is American and next to American it is Japanese, Greek and Hong Kong. The American part of the Liberian flag fleet is sometimes described as the "fly-away-fleet". The reason for this fleet's existence under the Liberian flag is that operating costs under the U.S. flag have been about three times foreign costs. Burdened with these costs, U.S. flag vessels have been unable to participate in international shipping operations. For American companies in the international tanker business it is a question of operating under foreign flag or not at all. It is therefore wrong to use the term "fly-away". The ships have not been transferred from the U.S. registry and did therefore not "fly away". If they were not under the Liberian flag (or Panamanian) they would not exist under American control at all. They were built abroad, mostly in Japan, and are manned by foreign crews. Their standard of safety is not lower than that of U.S. flag ships, since they were built to conform, with few exceptions, to U.S. Coast Guard rules. These American controlled tankers rank among the best operated vessels in the world and they cannot be said to deprive Americans of employment opportunities on ships, since, if they were

not operated under foreign flags with foreign crews, they would not be under American control at all.

A somewhat similar situation has developed in Japan during the last ten years. The Japanese Government permitted Japanese owners to register their newly built tankers under Liberian or Panamanian flag owned by Liberian or Panamanian companies and charter them long term on time or bareboat charter to themselves. The reason was that it became too costly to operate tankers under the Japanese flag.

The tremendous increase in the Liberian flag fleet and to a lesser extent in the Panamanian has taken place in spite of the strong opposition of the I.T.W.F., the International Transport Workers Federation which in 1958 organized a world-wide boycott of all so-called Flags of Convenience ships. The boycott lasted only 4 days and did not stop the expansion of the fleet. Boycott actions have since continued to take place from time to time in various ports of the world but the growth of the Flags of Convenience fleet continues. The Flags of Convenience fleets provide an important source of employment for labor of nations such as the Philippines, South Korea, Hong Kong and India. The wages offered Philippine seamen are in accordance with the tariff of the National Seamen Board of the Republic of the Philippines Department of Labor. It gives the Philippine seamen earnings which are equal to or greater than those they can obtain ashore. They receive ample protection by the National Seamen's Board before, during and after employment. The wages paid to Philippine seamen can therefore not be described as "sub-standard". Fifty percent of the Philippinos employed in international shipping have high school diplomas, and about 40 percent are college graduates. This is explained in part by the limited employment opportunities at home and by the comparatively high wages offered by international shipping. An ordinary seaman can earn a wage that is equal to or even exceeds the earnings of dentists, nurses and engineers ashore. The same is largely the case with South Korean, Hong Kong and Indian seamen.

TANKER SIZES

Having dealt with the ownership categories of the tanker fleet and the different flags let us take a look at the ships themselves and as a first step look at their sizes. This is very important since the IMCO February 1978 Protocols establish different rules for different sizes of ships. Since the end of the second world war a revolution in the size of tankers has taken place. Prior to that war a tanker of 15,000 dwt was a very large vessel, close to the optimum of what could find employment in those days. A far reaching decision made by major oil companies to site refineries away from the areas of oil production and near to the centers of oil consumption made much larger crude oil carriers not only operationally possible but economically necessary. Before the war it was usual to refine oil where it was produced and transport it across the oceans as multi-grade product cargoes in small tankers capable of segregating several grades of petroleum and discharge them at term-

inals with restricted harbor and storage facilities.

Construction of new refineries near points of consumption created a need and provided opportunities for larger and faster crude oil carriers capable of maintaining a reliable service between loading ports and deepwater terminals specially designed, sited and equipped to handle them, with vastly increased storage capacity in the near vicinity. Such deepwater terminals were constructed in all the major oil consuming countries of the world capable of handling crude oil carriers of up to and even exceeding 500,000 dwt; the one outstanding exception to this world wide development was the United States, where the maximum size of a crude oil carriers capable of discharging alongside a refinery is about 70,000 dwt. It is a strange paradox that the largest crude oil importing nation should be so lacking in adequate terminal facilities. I am assuming that this backwardness will within a few years be remedied to some extent by the new deepwater facilities in Texas and Louisiana.

Big ships are economically more efficient than small ones on any given route for which both are operationally suitable. Increased size produced increased economies for building; costs per deadweight ton fall, within certain limits as vessels become larger. From this it follows that depreciation, interest and insurance charges per ton of cargo carried fall too. Engine size increases less than proportionately to carrying capacity as does fuel consumption, and repair costs per ton of cargo show a progressive reduction as tankers become larger. Manning costs fall sharply too. From a shipowner's point of view there are obvious attractions in having a large ship. To operate a vessel of 250,000 dwt does not require more daily management effort than a vessel of 25,000 dwt.

The average size of the world's tanker and combined carrier fleet today is 94,242 dwt--a very large ship indeed. In some people's minds the development of the supertanker, the VLCC and ULCC, is in itself a source of pollution danger. To this my answer is that if the world's fleet had remained at the T2 level, about 15,400 dwt, so popular at the end of the last war, there would have been close to 25,000 tankers in existence today instead of about 4,000. With six times as many vessels approaching coastlines and entering and leaving ports, there can hardly be any doubt that there would have been many more collisions and other accidents. The popular argument that the growth in the size of the average tanker represents an increased risk of pollution does not hold water. The distribution in major size groups of today's tanker and combined carrier fleet is the following:

dwt Group	Number of Ships	dwt	% Total
6000/59,999	2,044	55,189	14.7
60,000/119,999	795	67,992	18.1
120,000/320,000 and over	1,144	252,187	67.2
	3,983	375,368	100.0

It is interesting to note that more than two-thirds of the world fleet consists today of ships over 120,000 dwt. There are 74 ships of more than 320,000 dwt. The 1978 protocols established different rules for vessels of 40,000 dwt and up and 70,000 dwt and up. Unfortunately, my statistical source uses a slightly different grouping but we can estimate that over 80 percent of the world fleet today is in excess of 70,000 dwt. The average size of the oil company owned tonnage (tankers only) was per July 1st 1978 a little larger than the average size of independently owned vessels, namely 114,818 dwt as against 98,782 dwt. Ten years ago, July 1st 1968, the average size of oil company owned tonnage was 38,711 dwt and independently owned 38,209 dwt. In other words, size-wise, the two groups were almost equal. The average size of the world fleet ten years ago was 35,917 dwt. During the last ten years the average size of tankers (and combination carriers) has much more than doubled.

Of great importance for our discussion of pollution prevention measures is an age analysis of the world's tanker fleet:

TABLE 3. AGE ANALYSIS OF TANKERS

Built	No. of Ships	dwt	Percent of Total Fleet	
1974-78	1,246	163,582	43.6	
1969-73	981	131,372	35.1	) 78.7%
1964-68	691	48,486	13.0	
1959-63	515	18,818	5.0	) 21.3%
Up to 58	550	13,110	3.3	)

If the 1978 protocols come into force in 1981 it will probably not be economically worth while to install segregated ballast tanks (SBT) or crude oil washing (COW) and inert gas system (IGS) in the two older groups of ships, namely those which in that year will be close to 20 years old or more. Those two age groups today account for 8.3% of the world fleet with a total deadweight of about 32 million dwt. Most, if not all, of these vessels will have to be scrapped. The same probably applies to a substantial proportion of the next age group, namely the 1964-68 group of about 48 million dwt equal to 13% of the world fleet today. In 1981 a number of these ships will be over 15 years old and will have their special survey to contend with. They are also scrapyard candidates. In other words 21.3% of the world fleet equal to about 80 million dwt are scrapyard candidates when attention is focused on the 1978 protocols.

The figures show that 78.7% of the world fleet was built in 1969 or after and as much as 43.6% after 1974. These latter groups will in 1981 be seven years old or less. These are the

groups which obviously will have to go to the expense of complying with the 1978 protocols. A number of the ships in this group have already complied with at least part of the 1978 requirements. The measures agreed upon by the IMCO conference in February 1978 will be expensive. It is therefore of vital importance to examine the state of the tanker industry. Will the industry be able to afford the cost of these desirable measures?

THE STATE OF THE TANKER INDUSTRY

You doubtless all know that the industry has (except for a slight and probably temporary improvement a couple of months ago) been in a state of severe depression since late in 1973 when the tanker market collapsed. The causes of the collapse were mainly two: the quadrupling by OPEC of the price of crude oil and the enormous supply of new tonnage which hit the market in 1973 and subsequent four years. The industry had expected a continued great increase in the importation of crude oil by the Western Nations, particularly the U. S. Instead the quadrupling of the price of oil caused imports to remain unchanged and even decline.

The poor state of the industry is reflected in a very large amount of laid up tonnage and extended practice of slow steaming. As of August 1, 1978 tankers in lay up amounted to 44.4 million dwt, equal to 13.53% of the total world fleet. The percentage of laid up tonnage was greater in the large ship groups than in the small groups. The following figures per October 1, 1978 illustrate this point:

TABLE 4 : SIZE DISTRIBUTION OF LAID UP TONNAGE (OCTOBER 1 1978)

dwt Group	dwt of Laid Up Tonnage		% of total Laid Up Tonnage
10 - 50,000	99	2,632,479	5.94
50 - 100,000	61	4,460,398	10.05
100 - 200,000	83	11,381,271	25.63
over 200,000	103	25,921,835	58.38

It is remarkable that over 58% of the tonnage laid up consists of ships over 200,000 dwt and 84% over 100,000 dwt. The age distribution of the laid up tonnage is also of importance:

TABLE 5 : AGE DISTRIBUTION OF LAID UP TONNAGE (OCTOBER 1 1978)

Before 1960		1960-1969		1970 Onwards		Totals	
	dwt		dwt		dwt		dwt
81	2,294,955	109	10,571,562	156	31,52-,466	346	44,395,983
%	5.17	%	23.80	%	71.03	%	100

These figures show that the laid up fleet consists to a surprisingly large extent of fairly new ships, over 71% having been built in 1970 and onwards. It follows from what I have said earlier that the laid up tonnage belongs mainly to independent owners. It is estimated that less than 5% of the oil company owned fleet is in lay up while almost 20% of the independently owned fleet is in lay up.

An important question is to what extent the independent owners, after nearly five years of depression in the tanker market will be able to pay for the implementation of the 1978 Safety and Anti-pollution Convention. I am not worrying about the about 27% of the world fleet which is owned by the oil companies since they have not been to any great extent affected by the tanker slump. It could even be argued that they have, at least some of them, benefitted by the extremely low freight rates which have prevailed. Nor am I worrying much about the 6.5% which I have described as government and domestic. These are vessels either owned by governments such as the Russian fleet or engaged in protective trades which exclude other flags. Since they are not engaged in competitive world trade they have not been much affected by the slump and it can therefore probably be assumed that they can afford to pay for the implementation of the 1978 protocols.

THE OUTLOOK FOR SCRAPPING OF TANKERS

So it boils down to the about 250,000,000 dwt owned by the independent owners. Two factors enter the picture at this point, the age groups and the distribution of size. Let me deal with the age groups first. Since the major question is cost, the owners will be faced with the decision either to comply or scrap. Before deciding to scrap, the owner will try to sell the ship at a little higher price than the scrap value but this merely means that the decision either to comply or scrap is transferred to another owner. I have already said that the group of ships which in 1981--the target date for implementation--will be close to 20 years old or more are almost sure to be scrapped. I purposely say "almost" since there have been periods in the tanker market's history when freight rates have been so high that a vessel of almost any age could afford to sail. However, these periods have been of such short duration that I think we can disregard them. I have also said that the next age group, namely the one which will be close to 15 years or more, is a likely scrapyard candidate. Here again I have to make reservations in regard to the state of the tanker market. If there should happen to be a boom, the compliance or scrap decision will, of course, be more likely to be that of compliance. Let me sum up by saying that the close to 20 years group of about 32,000,000 dwt is unlikely to be worth the cost of SBT or COW and the close to 15 years group of about 48,000,000 dwt is close to the same category unless the market is very good. Together these two groups represent a very large amount of tonnage over 80 million dwt which leads me to raise the following questions: Firstly, will the scrapping industry be able to take care of tonnage of that magnitude? The scrapping

figures for the last three years have been the following:

1975 :	8.3 million dwt
1976 :	11.9 million dwt
1977 :	10.0 million dwt

The figure for 1978 will show a remarkable increase, probably to about 15 million dwt, but we are still far away from the kind of volume the scrapping industry may be faced with come 1981. The important point I am making is that preparations should be made to expand the scrapping industry to take care of the increased volume. Already today, with a volume of possibly 15 million dwt, ships are lined up at the scrapyards in Taiwan awaiting their turn. What will it be like in 1981 and subsequent years when the volume will probably double?

SCRAPPING BY DEVELOPING NATIONS?

Since the principal factor in the scrapping industry is cheap labor it would seem that the implementation of the 1978 protocols might, with proper organization, be of major benefit to the developing nations whose labor supply is both cheap and ample. Upon the initiative of INTERTANKO, the Norwegian Government has agreed to participate in the financing of a feasibility study of the establishment of a major scrap yard near Karachi in Pakistan. The labor supply is ample and all that is needed is expertise and a moderate amount of capital to purchase equipment.

In the belief that the 1978 protocols will become law and close to 80 million dwt of tankers will become available for scrapping it would seem to make sense for the industrialized western nations to lend aid on a substantial scale to the developing nations to establish scrap yards. The developing nations are crying out for aid and instead of providing such aid by way of cash loans it would be better to help them establish such yards since this will immediately give employment to a great amount of labor. INTERTANKO is strongly in favor of getting rid of old substandard tankers wherever they are to be found. They are the worst polluters and the 1978 protocols aim at their elimination. If this benefit can be combined with the benefit of providing employment for the work forces of the developing nations the world will achieve two highly attractive and important objectives. I am drawing attention to this in the hope that it will reach the ears of those who are in a position to take appropriate action.

THE COST OF U.S. OIL IMPORTS

My second question relates to the large amount of tonnage which, because of age, will not be worthwhile meeting the cost of the 1978 protocols. This category of tonnage happens to be of the size which is suitable for carrying oil to the U.S., namely about 75,000

to 80,000 dwt. But the majority of ships of that size were built prior to 1968 and will therefore, in 1981, be close to the borderline of the cost problem. Will the 1978 protocols create a shortage of tonnage able to deliver crude oil to the U.S. terminals? If so a rise in the freight rates for that size of ship appears inevitable. The owners will need such increase in order to comply with the 1978 protocols. It will be the U.S. consumer who will have to pay for the United States having let itself remain for so long backward in regard to deepwater discharge ports.

TRANSPORTATION OF ALASKA CRUDE OIL

This review of the tanker industry would not be complete without a brief reference to the fleet of U.S. tankers employed in the transportation of Alaska crude oil. U.S. flag tankers of about 150,000 to 170,000 dwt are carrying oil from Valdez to Parita Bay near the Pacific entrance to the Panama Canal where it is off-loaded into two VLCC's which are laid up as storage vessels. A fleet of about 30 U.S. flag vessels are engaged in the transportation of the crude from Parita Bay through the Canal to ports in the U.S. Gulf or East Coast. This trade is known as "Jones Act Trade" which means that only U.S. flag vessels can participate in it. What will happen to these U.S. flag tankers when the London protocols become effective? My guess is that although this trade is protected by the Jones Act a number of U.S. flag vessels will have to be scrapped since they are already very old. They will probably be substituted by new ships built in U.S. yards. The cost of transporting Alaska oil in this way from Valdez to Galveston is extremely high, namely about $22.50 per ton. INTERTANKO's Secretariat calculates that Alaska oil could be transported in foreign flag VLCCs from Valdez via Cape Horn to Galveston at a total transportation cost of about $11 per ton or in other words about one-half of the present cost. The $11 per ton includes lightering at Heald Bank into smaller vessels able to enter Galveston Bay. These figures speak for themselves. As part of the fight against inflation in the U.S. would it not make sense to transport some of the Alaska oil in foreign flag vessels round Cape Horn at a saving of about $10 per ton to the U.S. consumer?

S. Butler: John Devanney, the intended speaker, who is on sabbatical from the Ocean Engineering Institute at M.I.T. has been called to Houston, Texas. His senior colleague at M.I.T., Professor Ernst Frankel, has graciously agreed to substitute his own observations on matters germane to Mr. Devanney's subject.

TANKER DEMAND MODELS: OBSERVATIONS

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I'm not sure that I can make remarks that are germane to Jack Devanney's proposed speech. I don't really know what he was going to say because Jack has been on leave from M.I.T. since June. I do know a little about his modeling approach and the type of work he's been doing during the last six or seven years. A large amount of effort has been devoted at M.I.T. to the development of tanker demand models.

There are dynamic demand models which can take into consideration variations in both supply and demand, variations in the distribution of not only production and consumption centers, but also refining of oil products. The refining must be considered because the flow of petroleum in this nation is bound to change as larger and more refineries are built closer to the crude production center; this is quite contrary to the traditional way oil was handled when essentially everything from the well to the market was controlled by the large oil companies. A decreasing percentage of this flow is controlled by large oil companies, and an increasing number of producers now attempt, not only to control production, but also to control refining and, in some cases, also increasingly, the actual transportation of crude oil refined products. One of the problems that we have had at M.I.T. in trying to come up with any kind of forecast or projected future tanker demand is that there are no good statistics. For example, nobody

really knows what recoverable reserves mean because recoverable reserves have to be tied to something like dollars that we are willing to spend to recover the reserves; if we are willing to spend $10.00 to recover whatever can be recovered, we will recover a certain amount of barrels. If we are willing to spend twice as much, the recoverable amount will probably double or triple, and so forth. An oil geologist made a comment to me quite recently. He said that we don't know how much oil or other fossil fuels are available or recoverable and the reason is very simple: all projections that we make are ludicrous from a statistical point of view. Of all the accessible land areas of this globe--excluding Arctic surfaces, less than 2.8% have been surveyed. If we take accessible water surfaces into account--that means all the coastal zones with depths of less than 200 meters, an area about 70% of the land area we are talking about--we find that less than .4 of 1% has been surveyed. Who are we to make any kind of projection of what we have, expect to have, where we are going to find it and how we are going to transport it in the next 10, 20, 30, or 50 years based on this type of statistical sample? With today's technology, efforts to go deeper, to extract from lower quality wells, and to re-extract from wells that were abandoned ten or fifteen years ago have been extremely lucrative; today I understand that 4% of the total continental U.S. production of oil is derived from secondary recovery of earlier abandoned wells. There are some serious questions of how much we can extract from all the abandoned wells in the United States, abandoned five or more years ago because of the lack of technology then.

The M.I.T. tanker model is essentially an origin destination model. It's a very large model which can look at all the past, existing, and potential centers of crude production. It can look at all the possible existing and potential developments of refinery centers. It also considers current and expected consumption in the major categories of crude and refined products. It introduces various potential developments in transportation costs and permits consideration of port terminal characteristics and capacity, particularly with regard to the size of tankers. It then projects the resulting demand in total tanker tonnage, by distribution of tanker size and category. It can also, as a result, determine not only the distribution of size, but the distribution of size and average voyage distance. It also looks at other backhaul cargoes and triangular routes and what opportunities they provide. The model then gives the statistics. The work done by Dr. Devaney was as I understand initially sponsored by OPEC which funded his work up to a few years ago, I think. Jack expanded this model to an economic model in order to project charter rates for tankers in the future. He has used his model as kind of a hindsight testing tool where he examined how accurately the model would have projected charter rates had it been in existence, say, from 1968 to today. I looked at his results and they are, as far as models go, fairly reliable and fairly well represent the actual trend of charter rates during the period 1968 to 1975 or 1976, which are the hindsight runs that were made. I obviously am in no position

to quote numbers here. I didn't know that I would be asked to talk about this 'distribution of crude oil and refined products by tankers' subject, but I would like to make a few comments based again on some of the results obtained in some of the independent studies made apart from the use of Jack's models, with regard to the near and long-term demand for tanker tonnage by various categories. Obviously, again, we are no soothsayers. We are probably more concerned than most people with the fact that you can't really predict anything because the only thing that's real or certain is that things are going to change. This has been driven home to me repeatedly.

We do a lot of foreign work relating to tanker operation in Nigeria, Indonesia, Malaysia, Venezuela, and so on, and it is interesting to note that it appears that there are few places in the world where, if you are willing to spend enough money and go deep enough, you can't find any hydrocarbons. For example, I was in Malaysia just two months ago. After many, many years of exploration there by some of the major companies who didn't go very deep and didn't really go offshore, there were some very major oil discoveries made. Now there was a country that was put down at the time in all the oil statistics, as part of the world at the time, that would depend on continued oil imports. Malaysia was self-sufficient in 1977 only four years after striking oil and by 1978 exported 250,000 BPD. The same kind of thing is happening all over the world. We know that England expects to be self-sufficient in the not too distant future and export at least a limited amount.

Intensive exploration efforts are underway in the Guyana region of Venezuela, considering that over 90% of the world oil is produced in the Orinoco basin, with some very new and very large discoveries. By non-OPEC nations, the question now is really, where is the oil going to be produced in the future? Where will we need tankers? All we can say is that the increase in the landed cost of oil has resulted in determined, and often expensive efforts to uncover new sources. Most of these new sources are definitely going to be much closer to the consumption centers. As a result, we project that the average distance over which crude and increasingly refined products will be carried will be considerably less in the future. While I am in no position to say if the actual demand for imported oil by the western nations is going to increase at a rate of 2.8% or 4.4%, if our demand in the United States is going to increase at those rates mentioned before, I *can* say that, according to the information we have, the distances over which this crude or refined product is going to be carried will be significantly shorter. Sources of supply will proliferate to a much larger extent than they have in the past. A much smaller percentage of oil transported will come from the major producing centers like the Middle East. As a result, the whole distribution pattern of tanker transportation is, in our opinion, bound to change drastically. This offers many opportunities, particularly for people like me who are more in the port than in the tanker business, because the demand for new port facilities, new terminals, new storage facilities will vastly outgrow the

demand for new tankers. We feel that, by and large, demand for tanker tonnage will not increase, in the foreseeable future, not even by 3% a year; it will barely stay level. The reason is that although the actual amount of imported oil may increase slightly, particularly if we can't restrain our own consumption in this country, if we can't find a way to get Alaskan oil to the midwest and the east coast, the ton/mile effort in tanker transporation will, in our opinion, actually decrease by 2-3% every year from now on and will continue to decrease until the end of the century. We also foresee that, because of the decrease of the average distance over which crude and refined products are going to be carried, the average size of tankers will not increase further. We feel that the 94,000 ton average size may increase to 100,000 or 102,000 tons, with the standard new tanker built in the 80 to 180,000 ton range; this is mainly because we expect in the future to be able to bring our supplies closer to the nucleus of the distribution network, and also because an increasing amount of oil will be transported as refined product, not crude. I think I would like to leave it with these comments. I'll be glad to answer more detailed questions on the models that Jack would have discussed much more eloquently. He probably would have presented to you many of his results, statistics, and discussed his assumptions and so on. I'd like to say that, of all the tanker demand models I know, and there are hundreds floating around, his is probably the most well structured. It's well designed, extremely flexible, and, contrary to most, permits any type and a large number of extremely flexible scenarios to be introduced and is therefore a very effective working tool which can be used to test the impact of inevitably changing conditions.

S. Butler: Professor Frankel, thank you very much. The speakers will now entertain questions.

PANEL PRESENTATIONS AND DISCUSSION

PANEL MEMBERS

Shirley Oakes Butler, Chairperson
James W. Curlin
John A. Dugger
Ernst G. Frankel
Peter Hetzler
Ronald K. Kiss
Charles M. Lynch
Erling D. Naess
William R. Stanley
Deborah J. Stirling

Hal Scott: My name is Hal Scott. I'm from the Florida Audubon Society. Mr. Naess, you accused environmentalists of having objected to deep water ports. Apparently, you are unaware that environmentalists worked with the oil industry for passage of the Deep Water Ports Act. In the only two deep water port licensing processes undertaken to date (Loop and Sea Dock) the State of Florida and the Florida Audubon Society opposed issuance of the licenses until adequate procedures were established to assure safe passage of supertankers through the Straits of Florida. We did not object to the deep water port concept or to the use of supertankers. We merely sought to insure their safe operation. There has been, to my knowledge, no organized objection by environmentalists against deep water ports.

Naess: If I stand corrected, I do so with a smiling face. The only thing I'd like to add to that comment is that when the Alaska pipeline was delayed for about four years because the caribous might not be able to move from one side of the pipeline to the other, didn't the environmentalists have a little bit of a say in that connection?

Scott: If you desire to discuss the Alaska Pipeline, Mr. Naess, we'll be here a long time. You're wrong. Conservationists were

concerned with far more than whether caribou could move from one side of the pipeline to the other. Given the constraints on our time, may I suggest we continue with deep water ports? I'll debate with you any day about whether environmentalists have done anything that is detrimental to the development of deep water ports in the U.S. They have not!

S. Butler: I think that's fair comment, Mr. Scott. Next question.

James Butler: I'm James Butler, Harvard University. I wanted to make a comment in connection with Mr. Naess's presentation about the older tankers. I've recently had communications with Arthur McKenzie of the Tanker Advisory Center in which he broke down serious accidents, total losses of tankers, for example, by flag and by the year, class, and so forth.

McKenzie's Tanker Advisory Center Newsletter dated June 4, 1978, gives a summary of oil spills for the period 1973-1977 which breaks down as follows:

21 spills due to	Weather Damage	164 thousand tons	22%
39 spills due to	Strandings	370 thousand tons	49%
26 spills due to	Collisions	40 thousand tons	5%
40 spills due to	Contact with dock, mooring	8 thousand tons	1%
4 spills due to	Fire/explosion	34 thousand tons	5%
77 spills due to	Other	137 thousand tons	18%

I would include "weather damage", fires, explosions", and "other" all in my category "open ocean", totalling 45%. Some of the collisions were probably sufficiently far from land to be included also; the "fires/explosions" category is almost all from one spill, the *St. Peter*, in the equatorial Pacific.

It was very interesting to find out that almost half of the tankers lost at sea, which thereby lose their cargo, are on the open ocean. These are almost all old tankers which suffered from structural failures; the largest one that I know of was a 100,000 ton tanker which was more than 15 years old. The rest of the accidents are primarily groundings, and there are almost no collisions involved. The occasional collision is given a lot of publicity, but structual failures and groundings account for most of the losses of tankers. Is that correct?

Naess: Yes, I believe you are quite right.

Frank Wiswall: Frank Wiswall, Liberian Services. This is a comment thinly disguised as a question. Taking into account the independent and entrepreneurial nature of the majority of the Liberian Flag fleet, we now have over 30% of that fleet in lay-up. We very quickly saw, when lay-up began, the older, less efficient vessels going to scrap. Bearing in mind that the deterioration

of vessels in lay-up is highly accelerated compared with the deterioration of ships in service, we've now had four years of lay-up of some vessels of modern construction that went directly from the shipyard into lay-up. And although we're more optimistic than Mr. Naess, in 1980-85, there is going to be a very high factor eligible for scrap. And bearing in mind that the entrepreneurial ship owner is not going to wait for the bottom of the scrap market to fall out before he takes what he can get out of his investment, how long does Mr. Naess think it will be before we see the first vessel--a large oil tanker or VLCC,--going directly from the shipyard into lay-up, and directly from lay-up into scrap without ever having made an oil voyage?
Naess: It has already happened. That's the only answer that I can give you--that it has happened--that a VLCC has never sailed and has gone to be sold for scrap.

Anita Yurchyshyn: I'm Anita Yurchyshyn of the Sierra Club International Program. I have a question for Mr. Naess. A recent report from the Netherlands Maritime Institute indicates that approximately seven times as many accidents happen to independently owned tankers than to those owned by oil companies. Admittedly, as you pointed out, the independents own 55% of the world's tankers, but do you feel that this accounts for the discrepancy in accident rates? Would you care to comment?

Naess: That's very awkward, if you say that we independent ship owners operate ships worse than the oil companies. That is completely new to me.

Yurchyshyn: The name of the report is "Sub-Standard Tankers," Published by the Netherland Maritime Institute in 1978. Most recently the findings of this report were reviewed in the May, 1978 issue of the *Marine Pollution Bulletin.*

Naess: It's hard for me to believe that independent owners don't take care of their ships as well as the oil companies. We all know that human error is unavoidable however much we adhere to the 1978 Protocol and try to improve safety. I will have to look up that statistic and study it more before I can reply. I'm sorry.

Frankel: I know the report and it compares accident rates of oil company tankers versus all the rest. The majority of all non-oil company owned tankers are owned by independent oil companies. On the other hand, you will find that it also divides the statistics into those for long distance crude tankers and smaller ships, coastal traders and so on. I you could examine the statistics you would find that if you look at large tankers, for example, large long-distance independently owned or oil company owned tankers, their accident proneness or whatever, is about equal. So out of the statistics, we find, and the Dutch

actually reported it also, that there is a proneness of smaller, mostly coastal type tankers to more accidents. A very large percentage of those are non-oil companies owned in this country and elsewhere as well, oil companies largely concentrated, for economic and pricing reasons, on covering themselves for the long distance hauls and which have contracted by and large, for short distance hauls.

Ron Kiss: My name is Ron Kiss. I'm with the Maritime Administration, Office of Ship Construction. I just wanted to correct the gentleman from Harvard, at least to bring out some other statistics. He mentioned that structural failures at sea were the primary cause of loss or casualty. There was a report done by the Office of Technology Assessment covering a period from 1969 to 1974 in which the statistics indicated that out of 3,709 pollution incidents or casualties concerning tankers, 586 were related to structural failure.

J. Butler: That's right in terms of numbers, but I was thinking in terms of tonnage.

Kiss: In terms of tonnage, 340,000 tons out of 1,100,000. It *is* the primary number, but I though you said it was about 50%.

J. Butler: Well, those were the figures that I had. That's close enough.

Kiss: These were in different years. Also, in terms of collision and grounding, collisions account for two hundred and some odd thousand in that period compared to 300,000 for the groundings. This fluctuates from year to year, depending on which one is the big one that year. If you had a big grounding, groundings are going to dominate the collisions. If you have a serious collision, it's the other way around.

Harvey Silverstein: Harvey Silverstein from the University of South Carolina. I'd like to address this also thinly disguised comment to both John Dugger and Professor Frankel because it seems to me that we have the typical situation of government projections totally at odds with academic observations. This also goes to the bottom line of exactly what we're talking about today concerning future utilization of oil. If what Professor Frankel says is true, we will not have level or declining consumption of petroleum products, but a very great increase as knowledge, awareness, and production of these sources becomes known. This bothers me because we are already reaching the point of interference with the atmosphere from production of carbon dioxide through consumption of petroleum as fuel. I'd just like to ask the panelists to react to this question. Are we indeed in for a constant increase in consumption of petroleum with a consequent rise in atmospheric CO_2?

Frankel: I don't think I said anything about consumption. I said

that, with regard to recoverable reserves, our present estimates must be modified and be associated with the price we're willing to pay for production. If we are willing to spend more for production, if we are willing to charge the consumer $2.00 a gallon, if we are willing to pay the producer $30.00 a barrel to produce, I assure you that next year, or in two years, the Petroleum Institute will come up with a projection of recoverable U.S. reserves which is not 38 or 40 or 45 billion, but 120 billion barrels--just as simple as that. There have been studies to that effect, and I think that, while I don't disagree with most of the government's projections or statements, I think we have to modify them, as they depend on all kinds of factors such as policy issues and more. Right now, we don't want to charge the consumer any more than he's paying. As a result, he'll probably go on consuming because, with everything else going up, petroleum is one of the cheapest commodities around.

Dugger: I feel that in all the projections that we have discussed so far, you've got to look very carefully at the assumptions that have been made. I didn't, in my comments, add as many caveats as I really should have because I would have spent most of the time with caveats, but I agree totally that recoverable reserves, since they are indeed a function of price of petroleum, can very well turn out to be quite different from what is now forecast. This will vary with the price of alternative energies so that we may find ourselves in a situation where, if nuclear becomes cheaper or some solar breakthoughs are made or other alternative energy sources turn out to be good ones, petroleum consumption may indeed level off sooner than we think. On the other hand, if alternative technologies turn out to be flubs, if economic rates of growth are higher than we otherwise project, we may have the kind of situation that you described, Harvey. There's an aura of doubt that pervades the whole arena. You may be entirely right that we may be moving into an era where we have increasing pollution in the atmosphere because the alternatives are not working out as well as we might hope.

William M. Benkert: If I may say so to Mr. Dugger, who's an old friend of mine, do you really believe that the Department of Energy of the United States now has an energy policy? The very concept of our approaching Saudi Arabia, for example, and stressing to them the need to conserve oil, which you mentioned specifically, seems to me fantastic. I can't believe that our country, with the profligate use of oil and energy that we have in this country, that we have the guts to tell anybody else that they should be conserving oil or any other source of energy. Cannot something be done to foster this time element that you were talking about for the development and putting in place of nuclear energy? Of all the things that are talked about today by the Department of Energy, by the academic community, by everybody in terms of energy for the future, do you really feel that the Department of Energy is pushing the simplifying and the facilitating of the development

of nuclear energy for our country and for the world? I just would like to understand what the thinking is policy-wise.

Dugger: Could I divide my answer into three elements? On the first one I'd like to plead the Fifth Amendment, since I'm not in a position to say whether a policy has fully evolved. As to the second, are we really telling Saudi Arabia they ought to conserve because they may become part of the problem? I don't think I said precisely that and, if I did, then I misspoke. The people that we are encouraging to conserve, as well as hopefully our own people, are the developing countries that have a relatively low rate of energy consumption right now. We are trying to help them develop along the lines where they won't totally abuse the use of petroleum, in particular. They have a lot of people who could have the potential for using a lot more petroleum if they moved toward our level of consumption. So if we can encourage them to use energies other than petroleum, the world petroleum situation is going to be better off. We have one particular problem there and that's nuclear non-proliferation. We, on one hand, are trying to say, "Don't use a lot more oil" and on the other hand, "we're not going to be very happy about providing you with a wide range of nuclear facilities either". So our own policies are going to have to be straightened out. As to the rest of it, what are we doing to bring nuclear power faster on line? I mentioned that we are trying to get legislation through Congress now that will permit a unified standard process for setting up nuclear power plants, so that it will take 6½ rather than 12 years to get nuclear power on line. We're fighting the rather tough problems about what we are going to do about nuclear waste. To say that this problem has been solved would be a gross exaggeration. As a matter of fact, we don't really still have what seems to be a viable long-term policy on what to do with nuclear waste, although a new policy announcement by the President is expected soon.

S. Butler: I will ask the panelists to identify themselves briefly and describe their field of endeavor as it relates to the subject matter of this symposium. Following that, they might make a short statement as to whatever is uppermost on their minds, and then they are available for questions.

Deborah Stirling: My name is Deborah Stirling. I'm with the Senate Commerce Committee, Staff Counsel with the National Ocean Policy Study. Our committee is involved with tanker regulations and construction standards. I have to lay out a caveat here under the rules of my committee: any opinions or thoughts I express are my own, and do not represent the views of the Chairman or any other member of the Commerce Committee. I'd like to comment briefly on Mr. Naess's point about employment of crews from developing countries. I think we can all applaud that. I would hope we could all agree, however, that these crews should be subject to some type of reasonable training and safety standards. It is a well established fact that the primary cause of many tanker accidents is indeed

human error, and perhaps we can preclude more of these accidents from occurring by providing more highly trained crews. At the risk of causing problems, I would also point to the fact that the unions in the United States have not exactly been upholding their end of the bargain on keeping our American crews up to snuff either. Mr. Dugger made a comment that interested me greatly and that was about the possibility of a 1979 date for decontrol of oil. Strictly as a personal opinion, I was surprised to hear that. I would think, and of course looking at it from a Congressional viewpoint, that after all the blood that has been shed in the Senate and the House on natural gas decontrol, to undertake within a year of that effort another major decontrol effort would be absolutely incredible. I would be interested in talking with you a little further about why you think that may indeed be occurring. I have another point about nuclear power, coming from the state of South Carolina. Being very aware of Barnwell, and having done a bit of work in nuclear waste disposal and nuclear waste management along the way, I was under the impression that a great deal of the delay in the construction of nuclear power plants is not so much in line with streamlining government regulation, but that the delay is now primarily involved with spiraling inflationary costs. Perhaps you and I can take that up also at another time.

Kiss: I'm Ron Kiss from Maritime Administration, Director of the Office of Ship Construction. My involvement in this general area is primarily a professional one from the point of view of a ship designer and a naval architect. I've been with Maritime Administration for about 15 years. In 1970 when Congress passed a major revision to the Merchant Marine Act that permitted granting construction subsidies to tankers, Maritime Administration was taken to task by an environmental lawsuit concerning our failure to publish an environmental impact statement. At that time, I was in a position which caused me to get deeply involved in developing agency expertise in tanker design, something that we really hadn't had prior to that time. MARAD and I personally have been involved in numerous economic and environmental assessments of various construction or capital cost and also the operating cost of the various construction features, doing the best we can to try and pin down the construction or capital cost and also the operating cost of the various alternatives, and also to evaluate, as best we can, some of the environmental benefits. I, too, would like to say that, for purposes of what I say here, my opinions do not represent official MARAD positions, because I think I can be a little more frank and honest and talk to you as a naval architect and Ron Kiss, private citizen. One general comment on this morning's presentation--we've heard quite a few projections into the future and I've looked at some of these projections, and they are the most difficult things to make with any kind of accuracy. I'm not saying that we shouldn't make forecasts. I think they are necessary and you have to look at them, but it seems to me that it's step functions, things that nobody has projected, such as the embargo of oil in 1973 or certain international actions, wars, what have you, that really

cause the major changes to occur.

William Stanley: My name is Bill Stanley. I'm a professor of Transport Geography at the University of South Carolina. I'd like to restrict my comments primarily to the philosophy of the tanker industry and particularly within the context of trade routes. Prior to doing so, I'd also like to make a rhetorical comment. It seems that every morning when I shave, I look into the mirror and see that we've met the enemy, and that the enemy is essentially ourselves. We are the two-car family; we are the gluttons for energy consumption, particularly fossil fuel, and we seem to blame the carriers--in this case the tanker owner, the independent owner, and the oil companies--for a lot of the ills for which we really have ourselves to blame. For instance, with all the recent rhetoric in Congress and the Executive, we still don't have an energy policy, and the price of fuel in this country is ludicrously low. We need to have an environment in which we view the grounding of a tank ship and loss of oil much as we would view the sinking of a Spanish Galleon full of gold. We have to look upon oil as a resource which really is quite finite and one with infinite demand placed upon it. While there may be new sources of petroleum opening up, the real bonanzas likely already have been discovered. These are primarily in the Gulf area. Whether the average haul length of oil is reduced any appreciable amount, the industrialized countries are still going to import the bulk of it by ship and from the Gulf. There's no railroad going to the Gulf; there's no ocean pipeline. Ships invariably will have accidents. We can insist that the owners, to the extent that we can move into the realm of international law, have extra safeguards to prevent some accidents, but we still cannot prevent the calamities of the sea. We simply have to have a different perspective concerning this resource which we are using in ever increasing amounts, yet essentially refusing to pay for. We're asking the Arabs to increase their production and at the same time we're asking them not only to make sure there is enough oil on the market but that the prices do not get out of line. It's ludicrous. We're not looking at this honestly. We want our cake and wish to eat it too.

Charles Lynch: My name is Charles Lynch. I am Vice President of Marine Transportation for Atlantic Richfield Company. I am responsible for the movement of all water-borne shipments in our company. Today we're using four million tons of ships. In order to generate discussion questions, I did make a few points as all the presentations were made but I will restrict my comments to obervations on two of the presentations. I will just touch on those very briefly. First, Mr. Naess gave a beautiful presentation. However, I disagree with his position that ship owners pay the bills. Somehow I feel that we in the oil business pay the bills, or perhaps going a step further, perhaps the guy at the pump pays the bills. I'm not so sure I agree with Mr. Naess that ship owners always should pay the bills. Now, commenting on Asian seamen let me say that on our foreign fleet, I experimented with Asian seamen in the under officer and unlicensed

ranks a few years ago, always with western Europeans. I have great sympathy for the Asians. I have some concern about their degree of expertise, their training, and here we get back to people training and this sort of thing. So I have had problems there. I quite agree that large tankers do minimize pollution exposure. Next, I support the IMCO Convention or the IMCO Protocol. I hope that it is accepted by all maritime powers and am looking forward to its acceptance on an international scale. Being parochial for just a moment, we started retrofitting segregated ballast on all our vessels in excess of 100,000 dwt, and inert gas systems on all our ships approximately 18 monhts ago. That program is about 50-60 percent complete now, my point being that we recognized the need for IGS on our ships and had moved forward ahead of S682, which Mr. Carter recently signed into law. On this subject, Mr. Naess indicated that perhaps as much as 60 million tons of ships would be scrapped, and while I do agree with that, I can't see where that will create a real problem, very simply because, as I view it, there is a world glut or surplus of ships today of about 100,000 million tons. I agree with Mr. Naess that substandard ships should definitely be scrapped. Lastly, on Mr. Naess' presentation, I disagree that 70-80 thousand dwt is the largest vessel that may call at a U.S. port, simply because I'm bringing in 150's now after lightering approximately one-third of the cargo. Now to Dr. Frankel, I have one comment, and I would certainly like to talk with him on this later. He indicated that at MIT, I believe, they have a computer model that can forecast charter rates. We've played games with that one for years and years, and we have a computer model or several of them in our company covering this area, but have never been able to find one that will work. I'm at your mercy, ladies and gentlemen.

Frankel: I'm Ernst Frankel, M.I.T., with 14 years experience at sea. I operated ships, managed ports, and worked in shipyards for many years before I finally joined Academia. I returned again to shipyards and ports and back again to teaching. Our model is not perfect; it works as well as any I have seen. My interest in this panel, frankly, is restricted to the tanker industry and its future. I think we will have many other panels and discussions on the more detailed aspects of environmental impact and so on. My concern is really with the totallity of the tanker industry, particularly as I do spend a significant amount of time in developing countries. We cannot isolate the issues and place our blames in the traditional manner on independent tanker owned tonnage and ignore the tanker segment of government tonnage. I'm very much concerned with this ignored tanker segment because it's growing at a very much faster rate than any other. If we project government owned tanker growth, and if my statistics are correct, the largest percentage of purchases of redundant tonnage is not made by oil companies from independents, but by those ignored owners. I'm very much concerned with the UNCTAD 40/40/20 rule which currently excludes oil shipments but which is an international convention agreed by I think, 78 Maritime nations--which establishes that in trades, now and in the future, 40% will

be carried in national flag vessels, 40% in flag vessels of the trading partner, and only 20% in third country flag vessels. Many of the producing countries seem to be rapidly growing towards controlling their transportation of their production. I see a very great danger because we talk of "how do you control?', "how do you make tanker transportation safer, more environmentally acceptable?" and so forth; in the past, all of this transportation was owned and/or controlled by the western importing countries. Before very long, we may notice that a very significant proportion, if not a major proportion, may be out of our control, and many of the things we would like to impose may not be impossible. I am therefore very much concerned about the planning of total integrated tanker transportation. We can't go on with business as usual becuase it won't be as usual in the future. There are many new factors, and I really wish that we could devote some discussion to the questions "where are we going?"; "what is the future role of the independent, of the tanker, of the oil industry, and nationally owned tanker operations?", or "how does it all fit together?", "how does government policy fit in?", and "how can we guide what may be desirable for future scenarios of this kind?"

James Curlin: I'm James W. Curlin, Deputy Assistant Secretary for Policy with the Department of Commerce. I can contribute most by discussing process rather than substance because there are those at the table that certainly have a better handle on the substance than I. Part of our problem is indeed process. Mr. Naess brought this out quite eloquently when he mentioned the dilemma in which the United States finds itself in handling large volumes of oil with a port system that is essentially scaled for a different time, a different situation, a different problem. We have an extremely sophisticated form of government in which we are pursuing a large number of pluralistic societal goals and objectives. We're doing this in a representative way where the three branches of government interact in a strange, wonderful way. We have strong public participation. This is an extremely democratic approach that stretches out a time-line for decisions. And even then we don't have the luxury of being able to adhere to the extent of public participation that we would like. I believe this is exactly the dilemma--and I'm pleased to hear Professor Frankel lead into this and identify these as policy problems. For indeed they are. I've spent the last year and several months working on an evaluation of the status of U.S. ocean policy and the outstanding issues. One might characterize it a progress report on the Stratton Commission, if you like. The study was asked of the Department of Commerce by the President so that this Administration could formulate new directions in ocean policy. The thing that impressed me most after going through this exercise is that we have a lot of ocean policy that Congress has delivered us since the early 1970's. It is sophisticated and involved; probably better than any you can find in the entire world in any of the maritime nations. However, the executive branch--the executive departments--are unable to execute this sophisticated policy in a coordinated

way. What we're talking about here is not a deficiency in the concept or a breakdown in national will, but an inability to bring a large number of disparate pieces of the government together to establish, in a forceful way, the directions and processes needed to make these decisions and to get on with the job. Harking back closer to my day-to-day existence, I recall the analogy of trying to deal with disparate pieces of the Department of Commerce where the Maritime Administration and the National Oceanic and Atmospheric Administration are each a part. These agencies have extreme difficulty in dealing with exactly the same problems you're talking about here. Here are two agencies within the same department, essentially serving the same purpose, both having the same goals of doing the best for the nation. But they have extreme difficulty in coordinating their programs. The representative from the Sierra Club identified a completely different dimension of the problem. My concern is that we've not come to grips with the process problem. We can throw the statistics around all you like, and we can deal with the forecasts in any way you like, but the real crunch comes down to making decisions in a real time mode. I'm afraid what has happened is that we have allowed the momentum of the crises, if you will--certainly significant problems--to overtake us to the point that our sophisticated form of government is unable to deal with them in a direct way. Before anyone gets the wrong idea of what I am saying, I don't advocate it being done any differently. What it takes is national determination and strong leadership, and I am convinced that leadership must emanate from the top. Congress plays a very important role, but they are 535 people essentially responding as 535 people. The focus in this government must come through the White House. It will take strong direction from the Executive Office of the President in order to insure that the Executive Branch properly and efficiently implement the laws that have been enacted by Congress. This I believe is our greatest challenge.

Peter Hetzler: I'm Peter Hetzler. I'm Vice President of Marsh and McLennan. I spent four years sea duty as a gunnery officer on a destroyer, and 23 years in the Marine Division at Marsh and McLennan. When I appear at functions like this, everybody says, "Well, there's the bad guy from the insurance company." I may be the bad guy, but I'm not from an insurance company. We are insurance brokers. Our clients are, and my clients have been, among the tanker industry, some of the major oil companies both here and abroad, some of the major independent tanker owners (foreign flag as well as U.S.), and so my contribution is, if you wish, to tell what I can about how the world insurance market relates to the present problems of the tanker industry and also the present problems facing us all as far as pollution is concerned. Some of the comments I wanted to make--I agree with Charles Lynch about the Asian seamen situation. My friends in the Japanese market tell me that the Japanese tanker fleet has an extremely good insurance record. The Japanese Liberian Flag Fleets that hire South Korean and Philippine crews and the like have an abominable insurance record. Also,

just by way of comment on large tankers, whether this statistic is worth anything or not, the insurance industry shows that the major problems have been with the tankers around 75,000 dead weight tons. Larger than that and smaller than that the loss record is good. In his speech Mr. Naess mentioned the growth of the British flag which, frankly, surpised me, but I've been hearing lately from a lot of people that I deal with that the British flag is becoming a flag of convenience, a flag of necessity, to use Mr. Naess's words. Because of the ITF situation and the pressure by the ITF, it's almost cheaper now, or will be, to operate ships under the British flag than it is under the Liberian flag. I don't know the answer to that; I'm just throwing it out as a comment.

Unidentified Voice: Would you say that once more, please?

Hetzler: Because of the ITF pressure on Liberian owners, on Liberian registered vessels, it's becoming cheaper, or it certainly will become cheaper, to operate tankers under the British flag; therefore the British flag will become a flag of necessity. What we see as being probably one of the primary problems with tankers, bulk carriers, general cargo ships, and all other vessel types in the world today, whether it be on the oceans, the inland rivers, the Great Lakes, wherever, is that crew training seems to be everybody's biggest problem. Every paper you read from insurance companies, London Underwriters, or from elsewhere in the world market deals with this horrible problem. There aren't proper crews, and you can't get them. Mr. Naess said this. Everybody else has said this.

One final comment, which is something that I heard, and certainly, I'm not an expert on the energy bill. It doesn't sound as though anybody is. But what I have been told by our owners around the country is that one of their biggest objections to the energy bill is its hideous complexity and also, not speaking as perhaps oil producers but as private citizens, that the administration of it is going to require another 100,000 government employees. That's just a comment on what I've been hearing. I'm vulnerable to any questions on insurance that you would like to ask.

S. Butler: I now throw the discussion open to the floor, urging you to keep to the subject of this panel, namely, the future of the tanker industry.

Stanley: Bill Stanley, U.S.C. I'm not sure you're correct on this UNCTAD 40/40/20 clause. I don't believe it's been ratified. It's been submitted. It has to be ratified by countries in terms of tonnage or tonnage controlled, and it hasn't been ratified and certainly would not apply to bulk cargoes--not yet. I don't think there's really a realistic prospect of its being ratified.

S. Butler: Is everyone familiar with the UNCTAD draft? Please briefly describe the 40/40/20 clause for clarification.

Stanley: This is the clause where (through the medium of the

United Nations which is dominated the the Third World) those nations who object to the fact that the industrialized world is carrying a lion's share of the commerce to and from the Third World's ports, and in order to stimulate their own Merchant Marines, have proposed a formula by which 40% of all commerce to and from country A be carried by ships registered in country A; 40% by ships who are trading with country A; and 20% by other vessels. One of the objectives would be to stimulate domestic fleets. But I don't think the worlds maritime interests will support this. This would not be for bulk carriers, but for general cargo.

William Bardelmeier: I'm Bill Bardelmeier. I am an independent shipping consultant. I used to be Vice President of Marine Operations with the Marcona Group. We don't work in the liner trades a lot so I'm no normally involved in the 40/40/20 liner issue. However, I can tell you that Professor Frankel is indeed correct...that there is indeed a very recent move to expand the UNCTAD code beyond liners into bulk cargoes. This is an insidious move that everyone connected with the tanker trades ought to keep an eye upon. There is a very distinct movement on the part of UNCTAD in Geneva to meddle in the bulk movements as well. There is a rather fuzzy line of thinking wherein the argument goes that the developing nations are being insulted by flags of convenience. They don't look upon this as a source of employment for nationals, although, as Erling Naess probably pointed out, it indeed is a vital bit of employment for some nations that are furnishing crews; instead, Geneva is now implying that there's a degree of insult involved in this type of shipping. That is really the latest development in UNCTAD. I think they have every intention of trying to exert influence in the bulk field.

Mark Zacher: There are only six countries that have actually ratified the 40/40/20 and the prospect of anybody actually bringing it into effect economically is beyond the pale.

Kiss: Ron Kiss. There is another movement that maybe is even more restrictive than UNCTAD, and that's growing bi-lateralism. We're seeing it in some of our liner trades right now where the developing countries are excluding third flag carriers from the trade. They're not even giving them the 20%. I have some concerns about the possible implications of that, but it looks as if a 40/40/20 split might be more desirable for a third flag than a 50/50 split.

Frankel: Just a short comment. I've been in recent contact with UNCTAD on this question, and the fact of life is simply that a recent number of developing countries, even though they might not have legally ratified the 40/40/20 proposal, are actually implementing it. They are not implementing it with their own ships. They license foreign flag ships to carry cargoes on their behalf. The point is, although only six countries may have ratified the agreement, a much large number are actually implementing it or attempt-

ing its implementation. A very large number interpret this liner agreement very freely to cover a large number of commodities and my concern is that this consideration, if we let it go unchanged, will continue and will affect us, and no matter what we do, may be out of our control.

Silverstein: One of the resons why the developing countries are dealing with this issue in essentially their own forum, UNCTAD, is that IMCO has clearly avoided and stepped away from addressing developing country interests for years. In the original IMCO charter there is a provision for such economic issues, but the advanced shipping nations and the international shipping--not government--organizations have made an explicit point of moving IMCO away from any possible consideration of economic issues relevant to the developing countries. Furthermore, the developing countries have not been involved in a great deal of many of the technical formulations in the subcommittees and working groups where regulations are made that affect trade to the developing countries. I think what has happened in this case is that the developing countries have clearly moved to a forum they felt was more sympathetic to their interests, and that is why the issues are being addressed at UNCTAD rather than within IMCO.

Wiswall: About UNCTAD first. That is a very astute comment that's just been made. It's quite true, but I want to put the positive on it. It is in my view certainly a very good thing that IMCO was not involved in the economic issues because the economic issues politicize. If IMCO early on had been involved in these economic issues, it could not have been the effective international regulatory body that it has been. I think the proof of that is to see how effective UNCTAD has been and project its effectiveness. I think you might find agreement on instruments within UNCTAD, but when it comes to implementation and ratification, you're going to see something quite different. Most recently, the Hamburg Rules on carriage of goods by sea will be a primary example from now onwards. The other thing, if I can just make one quick comment, was one that I can't let pass. The remark was directed by Mr. Lynch to Mr. Naess that really it's not the ship owner who pays, it's the fellow at the pump island. That, if I may say, reflects the view of the conglomerate ship owner who has the power to pass the buck on down the line. But the independent owner has to make the decision whether he will invest his money, and that decision is going to be based upon his estimate of the chances of recovering the investment. If he feels that in the prevailing market he can't recover, he's not going to make the investment and the vessel is going to go to scrap.

Silverstein: In response to what you're saying, I think there is some truth to keeping IMCO out of political issues. However, what is not as well recognized is that many of the technical decisions taken under the guise of fire safety, oil pollution, equipment specifications and others contain strong economic and political implications for the developing countries. Where such

technical decisions have been taken without developing countries playing a role other than voting on final passage of a convention, I believe you will find minimum interest and perhaps minimum ability to put technical regulations into effect.

Stirling: I have a quick comment on Mr. Wiswall's point about IMCO. I think there's considerable disagreement with your statement that IMCO has been an effective regulator as far as safety conventions and things of that nature are concerned. This was the reason why S.682, the Tanker and Vessel Safety Act, was introduced in the last Congress. I believe the Congress is generally pleased over the success that the Coast Guard and the State Department have had during this last round of negotiations at IMCO on tanker construction standards, but I cannot agree with you that IMCO has been an effective regulator.

Benkert: If I may say a word about IMCO in this regard. I think that what has been said regarding the past of IMCO, being the wealthy, developed-country, nice little "closed club," has gone down the drain in recent times because of the development in IMCO of a politicized block, exerting some muscle in the IMCO forum. This has been very apparent in the last three or four conferences and even in some of the subcommittee work that has taken place in IMCO. I think that what you are seeing, for better or for worse, is the gradual politicizing of IMCO in the same manner as some other United Nations bodies which haven't produced anything over the years. Now I would like to say this: in my opinion, you can't blame non-action or slowness on IMCO. IMCO is a group of countries and, in my opinion, has accomplished a tremendous amount of good work on an international basis, particularly in recent years. Everything may not have been done to the extent that you would like, perhaps, but the results must be measured as countries ratifying and implementing IMCO agreements. The United States has been one of the prime malefactors in IMCO, pushing everybody into all sorts of agreements, most of them very good. I know, I've been personally involved for seven or eight years in this "pushing" IMCO into new requirements, new agreements, at the request of the President of the United States. But when we come back to the United States, we run into all sorts of things which cause delay in ratification. Frankly, it's very difficult for the United States to hold its head up in the international forum if you beat on everybody to accomplish something, and you come back and sit on your duff.

O'Neill: I'm Trevor O'Neill from the state of California and I have a comment. We have been talking about who pays for the various improvements that might be required, and we heard that ship owners or other parties might pay. Let's not forget that a U.S. flag ship required to retrofit anything can write that cost off as a business expense and we, the taxpayers, will share the cost of that--just to be more accurate on who's paying for these things. My question is for Mr. Hetzler, maybe for Mr. Naess as well. On the insurance aspect of the tanker industry, my question is 'to what extent now

and to what extent in the future may the premiums that an operator pays for a given tanker reflect the previous operating record of that operator or that tanker; are those premium differentials, to the extent that there are any, based on the tanker's casualty record or its previous performance, and are they large enough so they encourage a tanker operator to clean up his act?'

Hetzler: All marine insurance is basically uncontrolled so that all premiums are based on an individual owner's experience, the condition of his vessels, and his loss record. In other words, if he has a bad loss record, he pays more than the guy who has a good loss record. At the moment, the marine insurance, specifically the physical damage side of the insurance business, is very much of a buyer's market. A lot of people in 1971 opened up their doors to marine insurance because it looked like values were up and there was a lot of premium around, so they thought they'd get some of it. Suddenly, the bottom fell out of the tanker industry and there was no premium coming in because all of the ships were being laid up and the values were going down. So now we're in the position, certainly in the United States, also throughout the world, of having an overcapacity of insurance companies. It's even worse in some of the European countries, such as Norway and Sweden especially, where you have a somewhat national market. Primarily, I'd say 75-80% of their businesses were their national fleets. They are now in the position of banging on our doors, looking for business from elsewhere, because otherwise they have no income. So the base of insurance premiums now is very low because of this competitive situation and because of the overcapacity in the market. Certainly, insurance premiums are going to continue to reflect an owner's own record and his management of his vessels, and the vessel's condition. It always has, and I suspect it always will.

Zacher: I'd like to make a few quick comments about IMCO. First of all, I'd like to concur with what Mr. Benkert has said about IMCO. His fundamental analysis concerning IMCO and U.S. policy in the past is correct. Second, despite the increased participation of the developing counries in IMCO they have not yet had an important impact on the development of IMCO convention. They have not mustered the technical expertise, nor the diplomatic coordination that would allow them to have a major effect. Not only that, but they do not possess and are unlikely to acquire major shares of the tanker industry. There has been a lot of talk about the oil exporting countries getting into the tanker ownership field, a matter to which Professor Frankel referred, but movements to date in that area have been marginal. At the moment the developing countries, apart from the flag-of-convenience countries, only have about seven or eight percent of world tanker tonnage. Most of their tankers are also involved in their own coastal trades. Hence, they have minimal economic interests in the international oil-transportation industry. Even if the developing countries do acquire more tanker tonnage, the developed states are still likely to maintain their preeminence in IMCO negotiations, because they are the major

importers and can lay down the ground rules for tankers coming into their ports. I think there is likely to be some increased friction in IMCO between the developing and the developed states on oil pollution regulations--especially as they relate to Coastal trades. However, through a variety of provisions in IMCO conventions, some of which are included in the TSPP Protocols, it is possible to allow the developing countries to control their own coastal trades in ways that satisfy them.

Stanley: I'll restrict my comments to tankers. I sometimes think that, since this is basically an American audience, we feel that if there are pollution problems with the tank ships, and the ship owners don't agree, then we'll send the Marines out and make them comply to what we believe are the appropriate laws. I think we must realize that the U.S. doesn't call the shots anymore, even though it's a major importer. It relies upon a complex economic system for bringing oil to our shores and there are market forces on the other end that we cannot control. We really don't even control our own end that well. We must realize that there is a force out there which we simply do not control.

TOPIC B

PROTECTION OF THE MARINE ENVIRONMENT

Winona B. Vernberg, Chairperson
University of South Carolina
Columbia, South Carolina

Our first speaker is Professor Butler from Harvard. He was trained as a chemical physicist; in recent years, though, he has been working on the fate of petroleum spilled in the open ocean, and on policy questions surrounding the oil pollution control. The subject of his address this morning is "Marine Pollution: How Big a Problem?

MARINE POLLUTION: HOW BIG A PROBLEM?

James N. Butler
Harvard University
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ABSTRACT: The input of petroleum hydrocarbons to the world oceans is probably not much different than it was five years ago, except for an increase in tanker accidents. However, the uncertainties in most of the measurements and estimates are so large that changes of more than a factor of two would not be easily noticed.

Evidence on the fate of petroleum in the open oceans is meager, but what little there is indicates that it disperses from the surface within a year. It is not destroyed, but migrates to the water column and sediments, where its residence time is much longer and degradation, if it occurs at all, is slow.

My topic for today is not quite as broad as the title Professor Vernberg assigned me might indicate. First of all, since we are concerned at this conference with oil tanker transportation, I will emphasize marine pollution by petroleum hydrocarbons resulting primarily from the transportation of crude oil by sea. The other sources of petroleum hydrocarbons I will mention only in passing, and I will not even list the many other pollutants that enter the

marine environment. Furthermore, I will discuss only attempts to quantify inputs and fates of petroleum, leaving the effects to Dr. Robinson, and tanker operations to Admiral Benkert.

INPUTS OF PETROLEUM

In 1973, I participated in the National Academy workshop on Inputs, Fates, and Effects of Petroleum in the Marine Environment. Although in that workshop I headed the "Fates" panel, I have taken the liberty today of presenting the conclusions of the "Inputs" panel (NAS 1975). In Table 1 you see the commonly quoted "best estimate" of petroleum inputs (which if you don't round off, adds up to 6.113 million metric tons per annum) as well as the *range* of values which the panel felt was reasonable. You will note that some of the values are much more precisely known than others. For example, nobody seems to know the precise amount coming from rivers, urban runoff, the atmosphere, or natural seeps. The atmospheric input of hydrocarbons has been well-reviewed by Duce (1978) and I will say only that neither the composition, the sources, nor the amount are well known.

Those of you from the production divisions of large oil companies (Wilson *et al.* 1974) know a lot more than I do about natural seeps, but I do know that there was a fierce argument among the panel members about the amount of this input. Estimates in the literature range from Blumer's (1972) estimate of about 0.002×10^6 tons/yr to Grossling's (1976) 7.0×10^6 tons/yr obtained by reinterpreting the results of Wilson *et al.* (1974). The NAS panel agreed to a range based on the review of Wilson *et al.* (1975), and a "best estimate" which was the arithmetic mean of their limits. I must remind you that natural seeps do not occur uniformly over the world oceans, but are generally localized in the same areas where production occurs. The best known natural seep is at Coal Oil Point in Santa Barbara which delivers 50 to 70 barrels per day (Allen *et al.* 1970) or 2.5 to 3.5×10^3 tons/yr. The rate of seepage in the Gulf of Mexico is knowable in principle, and probably known fairly accurately to those who decide where to drill for oil, but cannot be fully disclosed as long as there are still leases on which to bid. Finally, note that "seeps" also include the weathering of shales rich in fossil hydrocarbons, which produce hydrocarbon-rich sediments that can be transported to the marine environment.

You will notice that I have included in Table I some more recent estimates for these global input figures: Grossling (1976) distributes the amounts more heavily toward natural seeps, and makes a point about waste hydrocarbons from automotive and aviation operations, but minimizes the input from tanker operations. Smith (1976) gives essentially the same estimates for tankers as the NAS (1975), but omits river runoff, urban runoff, and atmospheric inputs.

In the last column I have compiled what I will term a "cynical estimate", which you will note uses the NAS figures (verified by

TABLE 1. PETROLEUM HYDROCARBONS ENTERING THE GLOBAL MARINE ENVIRONMENT (10^6 metric tons/yr)

Source	NAS, 1975 (range)	NAS, 1975 (best estimate)	Grossling 1976	Smith 1976	This work
LOT Tanker ballast	0.15 - 0.4	0.31			1.9[a]
Non-LOT Tanker ballast	0.65 - 1.0	0.77		1.0	1.4[a]
Cleaning for drydock	0.2 - 0.3	0.25	0.4		0.3
Bilges pumped at sea [b]	0.2 - 0.35	0.25		0.3	0.2
Tanker accidents at sea [b]	0.06 - 0.13	0.1	0.11	0.18	0.13[a]
Offshore production	0.08 - 0.15	0.08	<0.38	0.15	0.3
SUBTOTAL OPEN OCEAN	1.3 - 2.3	1.76	<.9	1.6	4.2
Bilges, bunkering [b]	0.2 - 0.35	0.25	included above	included above	0.3
Tanker accidents [b] near shore	0.06 - 0.13	0.1	0.11	0.17	0.12[a]
Other accidents	0.02 - 0.15	0.1	<0.02		0.1
Terminal operations	0.0015 - 0.005	0.003		included above	0.003
Coastal refineries	0.2 - 0.3	0.2	<0.62		0.2
Coastal municipal waste	0.3?	0.3	1.03 auto	1.3	0.2[c]
Urban runoff	0.1 - 0.5	0.3	0.65 aviation		1.5?
Coastal industrial (non-refinery) waste	0.3?	0.3	1.64		1.6?
SUBTOTAL COASTAL	1.2 - 2.0	1.55	4.1	1.5	4.0
River runoff	1.6?	1.6	-	-	1.6?
Atmosphere	0.4 - 0.8	0.6	-	-	0.6?
Natural seeps	0.2 - 1.0	0.6	0.24 - 7.0	0.6	0.6?
TOTAL	4.7 - 7.7	6.1	5.2 - 12.0	3.7	11.0?

a) A. McKenzie (1978) private communication. See Table III. About 50% of tanker accidents occur at sea.

b) Source makes no distinction between coastal and open ocean. Arbitrarily divided equally between the two categories.

c) Van Vleet and Quinn (1978).

Van Vleet and Quinn (1978) for coastal municipal wastes) or Grossling's (1976) figures, whichever is highest, except for tanker operations. Here I have relied on some estimates communicated to me by Arthur McKenzie of the Tanker Advisory Service (1978). His accident data come from Lloyds Register (Table 2) and the operational inputs are obtained as shown in Table 3. He has used the same production figures and projections as the NAS report, the same fraction of oil, transported by sea, the same proportion of crude, but has increased the clingage factor (the amount of crude oil sludge remaining after the cargo has been discharged) from 0.35% to 0.50%. This figure is well within range cited by the NAS report: "...from as low as 0.1% of carrying capacity for light refined products to as much as 1.5% for residual fuel oils." He also reduced the effectiveness of load-on top* from the optimistic 90% used by the NAS to 69%, which was the average value obtained in "hundreds of measurements at Rastanura in 1976 (McKenzie 1978). This higher figure has apparently gained some acceptance within the tanker industry. Gray (1978) testified to a congressional committee that current estimates of operational discharges are 1 to 3 million tons per annum. The result of these reasonable modifications is to increase the upper limit of the estimated input to the open ocean from 2.3 to 4.4 x 10^6 tons/yr. I do not mean to imply by this that the amount of petroleum entering the marine environment has doubled since 1973; rather, the range of reasonable estimates is larger than has been conventionally advertised.

Geographic distribution of petroleum inputs from all sources (not just natural seeps) is an important factor to be considered. For example, the *Amoco Cadiz* spill introduced as much oil into the coastal waters of a small area of France as municipal wastes *all over the world* introduce in a year.

In Table I, a distinction has been made between open ocean inputs and coastal inputs (although this has required arbitrary division of some estimates into two parts). I especially want to make this distinction because so little is known of the effects of oil on the open ocean ecosystem. Sampling is extremely variable, quantitative baseline data on pelagic ecosystems are almost nonexistent, and little field work has been done except for collection of tar lumps, sediment samples, and a few animals. Furthermore, some substantial fraction of the coastal input probably finds its way into the open ocean eventually, particularly the waste from municipal treatment plants, urban runoff, and industrial operations.

Coastal input tends to be localized in the regions around port cities, and thus its effects will be more obvious both because of the larger number of people to view them and because of the higher

* Load-on top (LOT) is a method of ballast handling. Instead of discharging all the polluted ballast overboard at sea, it is collected in a "slops tank" and allowed to separate. Only the aqueous phase is discharged, and the oily phase is retained to be combined with the next cargo.

TABLE 2: OIL SPILLS FROM TANKER ACCIDENTS*

Year	Oil Lost (10^3 tons/yr)	No. of Vessels on Jan. 1	Oil Transported by Sea (10^9 tons/yr)	% Lost
1973	84	3750	1.35	.0062
1974	67	3928	1.39	.0048
1975	188	4140	1.44	.0131
1976	204	4237	1.49	.0137
1977	213	4229	1.53	.0139
1978 (first half)	247	4137	1.58	.0156

* Compiled by A. McKenzie, Tanker Advisory Service, New York. Newsletter, September 29, 1978

log (oil transported by sea) = 0.01383 (year) - 27.1560

TABLE 3: ESTIMATES OF PETROLEUM HYDROCARBONS INTRODUCED TO THE SEA BY OPERATIONAL TANKER DISCHARGES (MCKENZIE 1976)

Estimated by		NAS	MCK*	MCK	MCK
Data Year		1971	1971	1975	1985
Production	BTA*	2.4	2.4	2.55	3.5
Oil Trans by Sea	%	56.5	56.5	56.5	56.5
Oil Trans by Sea	BTA	1.36	1.36	1.44	1.98
Crude Portion	%	81.18	-	-	-
Crude Portion	BTA	1.10	-	-	-
Clingage Factor	%	0.35	0.50	0.50	0.50
Clingage Factor	MTA*	3.85	6.78	7.20	9.88
Non-L-O-T * Tankers	5	20.0	20.0	20.0	20.0
Non-L-O-T Losses	MTA	.77	1.36	1.44	1.97
L-O-T Effectiveness	%	90.0	69.0	69.0	69.0
L-O-T Losses	MTA	.31	1.68	1.86	2.4
Total Operational Tanker Discharges	MTA	1.08	3.04	3.30	4.42

* McK = McKenzie
* BTA = billion tons per annum = 10^9 tons/yr.
* MTA = million tons per annum = 10^6 tons/yr.
* L-O-T = Load-on Top

concentration of petroleum hydrocarbons in the coastal environment of these areas. Studies of effects, however, are much easier, since benthic communities (like shellfish beds) tend to stay in one place,

and unpolluted control areas are relatively easy to define. However, I will let Dr. Robinson describe this type of work.

FATES OF PETROLEUM

Let me turn to the final question: Where does it all go? My research group at the Bermuda Biological Station and I have been addressing this problem since 1971. We and others have monitored the amount of pelagic tar lumps in many parts of the world (Butler et al. 1973) and as far as I can tell, there has not been much change (Knap et al. 1978). This lack of change doesn't mean that the tar lumps are staying stock of tar in the Sargasso Sea and compare it with the estimated input change (Knap et al. 1978). This lack of change doesn't mean that the tar lumps are staying around for 7 years; in fact, if you estimate the total standing stock of tar in the Sargasso Sea and compare it with the estimated input (primarily from tanker deballasting off the west coast of Africa) you come up with a residence time of a few months to a year. There is a lot of uncertainty in the sampling because of the complex surface currents, values from successive neuston tows* can vary by a factor of 10 and the mean of 16 neuston tows can vary by a factor of two, regardless of the time scale or the distance covered by the tow. Furthermore, you have seen that there is uncertainty in the input estimates of about a factor of 4; this uncertainty is increased somewhat by our poor knowledge about how much of the tanker ballast actually enters the Sargasso Sea. But in spite of the uncertainties, it appears that the residence time of petroleum residues at the surface of the ocean is not terribly long.

What happens to these tar lumps? One nice thing about studying the Sargasso Sea is that there are no continental land masses within it; only a single island, Bermuda. We have also monitored the tar that washes up on Bermuda beaches (Butler et al. 1973; Knap et al. 1978), and there seems to be no significant change since the studies were begun in 1971. Very little tar collects on these beaches, however, because the island is so small. We estimated 1 to 5 tons as the standing stock of beach tar, compared with 5×10^4 tons for the pelagic tar in the Sargasso Sea as a whole.

What happens to the tar when it disappears from the surface? The best clue comes from the collection and analysis of particles (1 to 100 um diameter) from the top 100 m of the water column (Morris et al. 1976). Many of these are the normal plankton and detritus, but some are little flakes of paraffinic petroleum residue, which apparently result from the disintegration of pelagic tar. These particles are probably scavenged by copepods and other zooplankton which are indiscriminate filter feeders, and packaged as

* The surface plankton of the ocean are known as *neuston*, and are sampled with a net towed at the side of a ship so that its mouth intercepts the surface of the water. A typical tow of a lm-wide net skims 1500 m^2 of ocean surface in 15 minutes.

fecal pellets which end up at the bottom of the sea. We know from our studies of the larger animals from the pelagic *Sargassum* community that there are substantial amounts of petroleum hydrocarbons in the tissues of crabs, fish, and mollusks. We thought the petroleum might be concentrated in the gut, but found the gills more heavily contaminated, especially in the crabs. This finding again argues for the particles as a primary mode of transport.

Studies of the sediment near Bermuda (Sleeter et al. 1978, 1979) and on the Abyssal Plain of the North Atlantic (Farrington and Tripp, 1977) have given detectable concentrations of hydrocarbons which are partly biogenic and partly identifiable as petroleum by the distribution of paraffinic components. The total amount of aliphatic petroleum hydrocarbons in the clean areas near Bermuda are as low as anywhere, but still are sufficiently high to account for many years' input. You may be comforted to know that we could not make a reasonable model that would account for all the oil ever spilled in the history of tanker transportation unless we invoked strong currents that mixed the sediments on the edge of the platform to a depth of more than a meter. However, model design is not impossible, and we must await results of our sediment trap experiments to know the actual flux of hydrocarbons from the surface to the sediments at the present time.

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QUESTIONS FROM THE AUDIENCE

Zacher: Mark Zacher, University of British Columbia. I have a comment on the estimate of LOT effectiveness. It's incredible to me, after having covered a lot of literature, talked to many industry and government officials and seen oil company data, to see the 90% effectiveness figure for LOT in the 1973 National Academy of Sciences Report. In 1972, four of the major oil companies did studies, which have been aluded to by a Shell official, Maurice Holdsworth, in a report to the 1976 Acapulco symposium, which indicated that one-third of the tankers arriving at their ports were using LOT relatively well. Lets just say this was 85-90% efficiency. One-third were using it very poorly; lets say that's 50% efficiency. And one-third were not using it at all.

Unidentified Voice: That's not a well publicized study, I'll tell you that.

Zacher: You are correct; it certainly is not. However, in July of this year, the House Subcommittee on Government Operations and Transportation asked the American Petroleum Institute to produce data on surveys over a period of years, and this will soon be published in the hearing proceedings. On the basis of that data, you cannot say absolutely what the effectiveness of LOT has been. But I think that if you use some common sense in looking at the

data, you would say that from 1972 to the present, the efficiency of LOT has probably gone up from the range of 40-50% to perhaps the range of 65-75%.

O'Neill: Trevor O'Neill from California with a note on the source of McKenzie's data. Hundreds of measurements were taken at Rastanura, which I guess is the big terminal in the Gulf. I believe those were Exxon's measurements and those were the ranges they found that were using LOT.

Benkert: Some of the people here may not be familiar with Load-on-Top. When you talk about Load-on-Top with many of the existing tankers today, there are a number of routes (some of which are depicted on a chart of the east coast of the United States) where Load-on-Top cannot be used as a practical method of separating oil from water in discharge over the side. There are a number of facets to the LOT system that give you a wide-range of efficiency; personnel training and the caliber of ownership, for example, and that's why you get this wide range in the efficiency. In looking at figures that are furnished, I really don't believe that they should be viewed with scepticism because the cost and the price of oil make it beneficial certainly to the operator, the shipper, the oil company, whoever is involved in the business, to save all the oil he can. He wants this oil. There is an economic incentive not to pump oil over the side and this of course led to the development of a system such as crude oil washing which, while giving you the "same type" of oil pollution prevention, saves you a whole lot of oil.

W. Vernberg: The next speaker is Dr. John Robinson who is an industrial engineer with NOAA. He has worked closely with the Coast Guard and has been known to give advice on environmental clean-up of oil spills.

ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS OF OIL POLLUTION INCIDENTS

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ABSTRACT: Assessment of the Impact of oil pollution is a subject of considerable complexity and controversy, and one which is surrounded by more than its share of institutional bias. Some hard information is beginning to emerge on which public policy, contingency planning, etc., might be based, especially with respect to an understanding of the major factors that govern the seriousness of impact from incident to incident. However, a major gap exists between scientific knowledge and public perception which must first be bridged before informed judgments are likely to emerge. Government scientists are now attempting to attack the problem along a broad front, from in-depth field studies at the scene of major incidents to after-the-fact assessment of socio-economic impacts and public perception of environmental damage.

INTRODUCTION

Before beginning this talk on the effects of petroleum from tanker incidents, I will give you some background on the organiza-

tion that I represent and our interest in the problem of marine pollution. The NOAA Hazardous Materials Response Program began in 1976, shortly before the grounding of the *Argo Merchant*, and has evolved into a significant effort directed at reducing and assessing the effects of major tanker accidents in the U.S. waters and abroad. The Program operates in close collaboration with the U.S. Coast Guard, the Environmental Protection Agency, a number of other Federal and state agencies and private institutions.

Over the past two years, we have responded to 18 oil pollution events ranging in seriousness and complexity from a small gasoline spill off the coast of Rhode Island to the 220,000 ton spill of the *Amoco Cadiz* (Hess, 1978). Unfortunately, even with this varied background we have compiled only fragmentary evidence about the effects of oil on the marine environment. The subject, as you are well aware, is both extremely complex and intensely controversial. Generalizations are difficult to derive and often do not stand up under intense scrutiny. Yet, we are working in an area in which judgments must be made on issues in which environmental factors are important, if not paramount, considerations. The subject of oil pollution effects is also one fraught with more than its share of bias. Rarely does a general interest article in a national magazine pass my desk which I feel was written without some underlying and usually very evident prejudice.

Not that scientists and scientific publications are free of the problem of bias, and this fact, in particular, makes my job and that of others in my field particularly difficult. We must extract from the literature information relevant to the decisions that must be made at the time of a spill. Bias in scientific publications that promotes a particular line of research or institutional viewpoint is often difficult to detect and sort out and can be particularly troublesome to those attempting to make knowledgeable decisions.

Quite often it is not what *is* published but what *is not* published which is the problem. Scientists are often not willing to make statements or commit to writing findings that cannot be substantiated beyond all "reasonable doubt," to use the legal jargon. Certainly, the public interest is being jeopardized, on occasion, when informed judgments are not forthcoming from those people in the best position to offer assistance.

The barrage of confusing and often conflicting statements by government, industry, and academic institutions, clearly has left the public poorly informed on the seriousness of oil pollution from tankers. Thus, we have a major task ahead of us as we attempt to untangle this maze of misconceptions and bring the public and our legislators to some reasonable understanding of the seriousness of oil in the marine environment. Those of us in the scientific arena must begin to synthesize our knowledge and present the public with a coherent picture of what we do know about the issue.

In my remarks today, I will give you an overview of what we know and do not know about the effects of petroleum released from tanker accidents, and also cover some information on what we are beginning to understand about the public's perception of the problem. At the end of this talk, I will give you a brief rundown on

the actions we are taking with the Environmental Protection Agency and the U.S. Coast Guard to mitigate some of the effects of future spills and to enhance our ability to evaluate the environmental and socioeconomic damage that result from such incidents.

FACTORS AFFECTING THE SERIOUSNESS OF PETROLEUM IMPACTS

First, I will briefly discuss what we know and do not know about the effect of petroleum in the marine environment. My first comment, and a point that is rather obvious, is that the effect of a given spill may vary from slight to serious depending upon a number of factors. The extent to which these factors interrelate and affect the eventual outcome is unfortunately not so obvious, although we are beginning to reach some reasonable level of understanding about the conditions and processes that are of the greatest significance. A common misconception here is that the overwhelming factor in determining the extent of damage is the quantity of oil spilled; however, a number of recent incidents have proved this is not actually the case.

The *Argo Merchant* incident was among the largest oil spills in history and certainly the largest along the coast of the United States. 7.6 million gallons of No. 6 fuel oil were released from the tanker over a period of days in the winter of 1976. Over 200 scientists investigated that incident, and their results are now beginning to be reported in scientific literature. The concensus appears to be that the acute effects of the spill were minimal. In our report of the incident, scheduled to be released in the next few weeks, we state (Morson, 1979):

> In summary, the results of studies to date in no way *conclusively* demonstrate the existence of any significant acute impact on the marine ecosystem from the *Argo Merchant* oil. While effects on some species have been observed in the field and demonstrated in the laboratory, there is no way at this time to extrapolate these effects to the marine ecosystem as a whole. Indeed, results seem to indicate that ... the impact ... was within tolerable limits for most species.

I should add that the sub-lethal effects of this spill are unlikely ever to be conclusively established.

In contrast to the *Argo Merchant* incident, another well-studied spill was that involving the barge *Florida*, which occurred in September 1969 offshore of Falmouth, Massachusetts. This spill involved 175,000 gallons of No. 2 fuel oil, roughly 2 percent of the cargo size of the *Argo Merchant*. This incident was well studied by a number of scientists over a period of years (Michael et al., 1975). In this spill, strong northwest winds drove the slick into the coastal salt marsh system, thoroughly mixing the oil into the water column and coastal sediments. Within days, the oil-soaked beaches

were littered with dead or dying fish, worms, crabs, lobsters, and other crustacea. Biological effects were observable in the subtidal and intertidal zones for the next six months as additional mortalities occurred. Long-term effects were demonstrated over the next seven years, and oil was reported to remain in the sediments nine years after the grounding.

The point to be made by reviewing these two spills is that the quantity of oil spilled is not necessarily a major factor in the equation of damage. Yet, the quantity spilled does indeed key certain actions by the U.S. Coast Guard and other Federal agencies in the area of spill response.

Another misconception, in my view, is that the damage from a particular spill is directly related to the number of organisms killed in the incident. This method of evaluating damage obviously offers a certain simplicity that is appealing to those looking for some manageable way of tallying up losses, but I personally doubt losses calculated in this manner mean much from an ecological perspective. A destroyed habitat may have significance well beyond the loss of the particular animals present at the time. In addition, this method of evaluating impact also fails to account for the myriad of sub-lethal effects that we know are often major factors affecting the overall quality of the environment.

At a more detailed level, we know that the effect of petroleum varies widely among the various populations and communities in the marine environment. Plankton that inhabit the upper layers of the ocean tend to be especially vulnerable to oil spills (Sanborn, 1977). The ability of zooplankton to ingest petroleum and incorporate its components into their tissues may be a primary method by which oil enters the food web and begins its subsequent effects on the higher trophic levels (Spooner, 1969). It is also reasonably clear that oil can have a dramatic effect on intertidal and subtidal benthic communities. Oil that reaches the shoreline or sinks to the ocean floor has effects both in its capability to smother animals, as well as being directly toxic (Clark, 1971; Crapp, 1971).

Little is known about the effects of petroleum on fish; however, the limited evidence available suggests that the mature animals tend not to be affected acutely (Clark, 1971). Some disruption of physiological parameters, however, has been noted (Grose and Mattson, 1977). Tainting is known to be a problem when large amounts of petroleum hydrocarbons are present.

One of the most apparent effects of oil spills is upon the bird populations in the region of the spill. Birds that live on the surface of the water or dive to collect food are among those most seriously affected (National Academy of Sciences, 1975). Early efforts to rehabilitate oiled birds tended to be generally non-productive; however, new research in this area may improve the situation measurably.

GENERAL CONCLUSIONS

Some general conclusions regarding the effects of petroleum are beginning to emerge: We find that, contrary to earlier opinion, many

organisms do not avoid regions of oil contamination, (see Patten, 1977; Malins et al., 1978, for examples). We find that certain intertidal species are less sensitive to the acute effects of oil exposure than subtidal species, perhaps because of the greater stress associated with the intertidal environment (Rice et al., 1979). We find that many organisms tend to recover rapidly once the oil has been removed (Brocksen et al., 1973), and furthermore that some organisms exposed to chronic low levels of pollution tend to be more tolerant than those that inhabit more pristine environments (Griffiths and Morita, 1978). We find that oil may act, on occasion, synergistically with other pollutants to aggravate the effects of both substances (Gruger et al., 1977). Of greater importance perhaps, we find much more serious ecological effects occurring in situations where the habitat has been seriously disrupted over an extensive period, as opposed to those situations where the persistence of contamination was brief, although possibly accompanied by large losses in resident populations over the short-term (Michael et al., 1975; Hyland and Schneider, 1976).

We are also quite aware that some effects of petroleum are likely to remain unknown despite our best efforts to uncover them. Potential uptake and biomagnification of oil through the food web has been a particularly difficult problem, as has been the problem of potential effects on man from the consumption of contaminated seafood. There are many hypothesized effects of a sub-lethal nature that, in my opinion, we are unlikely either to prove or to disprove within the next several years.

POTENTIAL DAMAGE INDEX

Now, to return briefly to my original contention that the quantity of oil spilled is not the overwhelmingly significant factor in determinging the seriousness of a spill. If the quantity is not significant, what is? To answer that question for the purpose of gaging our response to a particular spill incident, the Hazardous Materials Response Program has developed an evaluation procedure that establishes an "Index of Potential Damage" from information we receive from the U.S. Coast Guard during the first few hours of a spill event. This index, which results from a number of factors surrounding the spill, sets in motion one of several alternative response actions available to us. Our evaluation is admittedly quite subjective, but may give you some better insight about the factors that we consider important in determining the seriousness of a spill situation.

First, we want to know what cargo is involved. On the 0-100 point scale of our potential damage index, 20 points are allocated to this factor. Highly toxic cargos, such as No. 2 fuel oil, would receive a value of 20, ranging down to the non-fluid cargos, such as asphalt, which would receive a value of 1. In evaluating the seriousness of the cargo, we are concerned primarily with its toxicity, which is primarily a function of the relative amount of aromatic hydrocarbons present; however, we also consider the likely persistence of the particular oil, as well as its smothering potential.

Second, we want to know the potential quantity that may be lost into the environment. This factor is allowed another 10 points on our 0-100 point scale of potential damage, with spills over 500,000 gallons receiving the full 10 points.

The above factors show that we consider only 30 percent of the potential for damage to be involved in the two factors of cargo type and quantity. After evaluating these two factors, we proceed to look at the location of the spill, its likely trajectory, and prevailing environmental conditions. If the oil is likely to reach the shore, the third factor in our evaluation is the type of coastline that may be impacted based on our best estimate of the spill trajectory. From work undertaken by the University of South Carolina (Hayes et al., 1973), eight distinct coastal forms have been idenified with respect to the likely persistence of oil in the near shore. Salt marsh environments and other highly protected coastal environments are the more serious end of the scale; rocky headlands are the least vulnerable. A maximum 15 points in our evaluation scheme is allocated to the factor of shoreline type.

The fourth factor in our evaluation concerns the likely areal extent of contaminated shoreline. Ten points are allocated for this factor and the maximum is assigned for spills that are anticipated to extend along a section of coast greater than 10 miles.

The fifth and sixth factors concern the variety of biological habitat that is anticipated to be impacted. A total of 30 points is allocated to these factors; the maximum score is given to those areas that provide breeding or rearing areas for rare or endangered species. Fewer points would be accumulated depending on the criticality of the area in terms of its capability to support populations of ecological or commercial importance.

Two final factors, totaling 15 points relate to the prevailing sea conditions and the season of the year during which the spill occurs.

A similar evaluation system has been developed for spills that are anticipated to remain offshore. The evaluation criteria for offshore spills are significantly less complex, and reduced point values in these evaluations reflect our subjective judgment of the relative seriousness of offshore versus coastal impacts.

Remember that this scoring system is not only subjective, but also rather superficial in its approach. In addition, I should also point out that spills receiving similar scores on initial evaluation may prove to have quite distinct impacts, depending upon a number of more subtle factors. The effectiveness of efforts to contain and clean up the spill will also have a major bearing on the eventual impact. The evaluation method that is described here does, however, illustrate in a general way the major factors that we consider important in determining how serious a given spill is likely to be.

PUBLIC KNOWLEDGE AND PERCEPTION

The actual impact of a spill and how the public perceives the

impact are often quite unrelated. Our work at the scene of major spills has two major goals: (1) the mitigation of damage; and (2) the assessment of impact. In the latter area, we are concerned not only with direct environmental impact, but with socio-economic effects as well. In this latter area, we are concerned with the manner in which we communicate with the public, and thus, how the public perceives the seriousness of the spill.

You will recall from my earlier statements that we consider the *Argo Merchant* incident to have had rather slight acute environmental impact, certainly well below that observed in a number of other incidents. To gain a better understanding of the socio-economic impacts and how the public viewed the seriousness of the spill, the Program contracted with East Carolina University for an in-depth study of public understanding and perception of the *Argo Merchant* oil spill (Fricke and Maiolo, 1978).

The study was undertaken in the Cape Cod area, in the region of the spill, about a year after the incident, and was designed to determine: (1) how well the residents were informed about the *Argo Merchant* incident and the potential problem of oil pollution from tankers in general; and (2) their perception of the seriousness of the spill. We concurrently studied both the apparent magnitude of socio-economic impact that might be attributed to the spill, as well as the accuracy of press reports on the incident.

The conclusions of this study were as follows:

> First, no major socio-economic effects of the spill were evident in the assembly of indicators (fish-landings, recreational fishing expenditures, tourism, etc.) that were studied. In-depth interviews with 48 business people in the region likewise revealed no significant short-term impact on the economy of the region.
>
> The second observation was that press coverage of the event was both massive both and during and, after the spill incident an, for the most part, accurate in its presentation of the views of those who were best informed about the impact of the spill. Most scientific meetings and activities were well covered by both local and national media.

Given these two findings, we anticipated a rather well-informed public and one that would have, in general, not been overly alarmed by the impact of the spill, especially after the threat of shoreline impacts had passed and anticipated large-scale losses to the local economy failed to materialize. We were, wrong on both counts.

Sixty-nine percent of those surveyed were in our judgement, either poorly informed or uninformed of the incident that had occurred some 11 months earlier in their immediate vicinity. Most surprising, however, was that three-quarters of the respondents, whether informed or uninformed, felt the *Argo Merchant* incident had, in fact, been damaging to the economy and rather seriously disrup-

tive to the environment.

In particular, those surveyed most often cited oiled birds and oil slicks as forms of impact. Some respondents told of fishing boats that had been fouled by oil and of lobster and shellfish stocks that had been impacted. Others told of being unable to swim because of oil, of associations between *Argo Merchant* oil and the "red tide," of loss of tourist trade and other economic losses. Over 50 effects were described.

Approximately 40 percent of the sample reported that they had actually seen effects either first-hand or, as was more often the case, in the media. Respondents indicated that they had knowledge of effects on Cape Cod, Falmouth, West Falmouth, North Falmouth, Buzzards Bay, Woods Hole Harbor, Wings Neck, South Beach, North Beach, Cape Page, the New Jersey shore, San Francisco Bay, Santa Barbara, Bermuda, Virginia Beach, and Nova Scotia.

There was also significant concern with oil contamination of seafood landed in the local area. One person surveyed in Edgartown indicated:

> We stopped buying fish for awhile. Everyone told me it was all right, but I thought I'd better be safe than sorry. I served fish to my family for the first time this year on Memorial Day.

Some of those surveyed were very obviously emotionally affected by the spill and felt threatened by it. Others had feelings of depression, apprehension, or anger. One man on Nantucket indicated:

> Oil must have an effect on plankton life even if cleaned up. Everything survives in or from the water. Who are they kidding with asking if it affects us. Just because we don't see the oil doesn't mean it evaporated.

One man in Edgartown reported that he and some of his friends planned to move to a place "where there will be clean beaches for our grandchildren to enjoy in the future." A retired man on Nantucket indicated that all his activities had been affected. He no longer liked to walk on the beaches and the knowledge that the sea was dirty appalled him. A Nantucket woman indicated that the beaches had been closed and that she had been unable to exercise her dogs properly.

A number of conclusions can be drawn from this study, not the least of which is that effects perceived by the public have a way of becoming very real regardless of their scientific basis. Although it does not seem to have been the case with the *Argo Merchant*, the potential was certainly there for significant socio-economic losses from the spill, caused solely by the public's perception of the incident. Some of the observations were quite perceptive despite the lack of detailed knowledge, while others reflected gross exaggeration of published information.

This example of public reaction is not meant to make the point

that the public consistently overemphasizes the effects of oil spills. I expect that if we were to have studied public reactions to the earlier Falmouth spills that occurred in the same region, we might have found exactly the opposite conclusion--considerably less widespread concern for an incident that we know to have been serious. The point here is that despite the best efforts of the news media and others to report the facts, the information that we have to convey does not always seem to come through clearly. If we want an informed public, all of us who have contact with the public and the press must do better to express clearly what we know and don't know about the effects of such incidents. For scientists, we must learn to translate our information into non-technical language, and to be especially careful not to introduce additional bias into a subject that already has more than its share. In our response to spills, we take the topic of public information quite seriously.

FUTURE SCIENTIFIC RESPONSES

Since the *Argo Merchant* incident, in which the scientific community was very poorly prepared to deal with a problem of such scope and complexity, the Hazardous Materials Response Project has sponsored a number of planning workshops along the coast to discuss the best methods available to deal with spill situations from the scientific viewpoint. Workshops have now been held in Hartford, Connecticut; Anchorage, Alaska; Tampa, Florida; and Philadelphia, Pennsylvania. Two further meetings are scheduled for Charleston, South Carolina, and San Francisco, California. The result of the workshops held to date has been a fairly well-defined collection of thoughts about (1) what can be done to mitigate the environmental and socio-economic effects of spills when they happen, and (2) what steps should be taken to assess the damage that occurs in the larger incidents.

To follow up on the recommendations received from these workshops, NOAA and EPA, assisted by several other state and Federal agencies, have formed a Scientific Support Team that is available on-call around the clock to assist the U.S. Coast Guard and others in dealing with spill incidents. This Team is designed to bring to bear on the handling of a spill the latest research information that has been obtained from sources both in this country and abroad. Useful information was obtained by U.S. scientists assisting the French in dealing with the *Amoco Cadiz* incident; this experience will be of considerable value in both mitigating and assessing damage from future spills along the U.S. coastline.

Scientific Support Coordinators, who serve as chief scientists at the spill site, have now been identified by NOAA and EPA for most coastal regions. These individuals are, for the most part, working full-time to make certain that scientific consultation from a variety of fields is available on-scene within the first several hours of a spill incident. They are also working out the

protocols that will be necessary to assess the environmental and socio-economic damage caused by major spills.

CONCLUSION

Although it is unlikely that certain complex processes will be resolved over the short-term, information is beginning to emerge from scientific studies which should provide significant insight into the effects of petroleum in the marine environment. This information, if adequately communicated, will be of considerable value in the contingency planning and the mitigation of spill impact, as well as in formulation of public policy on issues surrounding marine transportation of petroleum.

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W. Vernberg: The third speaker in this series is RADM William M. Benkert, President of the American Institute of Merchant Shipping. He is an authority on commercial vessel safety and pollution prevention.

COMMENTS

William M. Benkert
American Institute of Merchant Shipping
Washington, D. C.

INTRODUCTION

My subject was supposed to be "Oil Pollution from Tankers" but I think that has been covered pretty well. I do want to pick up a couple of points that were mentioned earlier this morning and fit them into the context of some of the comments. The major items concerning oil pollution from tankers that I had intended to cover were those previously discussed by Dr. James Butler, particularly the table which listed the various sources of pollution from tankers. In view of the fact that Dr. Butler went through the list, I would like to make a couple of points on the figures that I think are pertinent in appraising this subject.

OPERATIONAL AND ACCIDENTAL OIL POLLUTION

When pollution from tankers is appraised, it is designated operational or accidental. The table presented by Dr. Butler gave at least some ball park figures which I think everyone would readily agree are quite haphazard in these areas. With regard to those figures which dealt with the amount of oil entering the ocean from tankers on an operational basis, the range is so wide that the use of the figures seems to me immaterial; the point to be made is that there is a great

deal of oil entering the oceans from operational activities aboard ship. One of the things that needs to be approached, and *is* being approached, both nationally and internationally, by everyone in the business, is the elimination of the problem at its operational end. Some of this problem can be eliminated by design and construction features. Some of the operational pollution really can only be looked at through *people*--what people man the ship and what type of equipment is aboard to facilitate the personnel alleviating operational pollution. Unfortunately, in my opinion this is part of the problem that has not been extensively approached in the past, either through IMCO up until very recently, or really in any other form except by the enlightened ship owner. With respect to operational pollution where *people* are involved: much of what happens aboard the vessel is dependent upon the ship owner and the policies he enforces aboard his vessel. Everyone agrees on the need to get rid of substandard ships and substandard ship owners. A great deal has been done toward this end, particularly in recent years. Another part of the *people* problem involves the training and qualifications of the personnel aboard ship. I think it was mentioned briefly this morning during a panel, but again, the ship owner and the people themselves aboard the ship are part and parcel of what must be done to resolve this problem. IMCO is making the effort on an international level. Enlightened management and labor, and all the other sectors involved in this business have been working on the training, qualifications, and capabilities of people. What must be injected into the people aboard ship are not not only these capabilities and qualifications, but also the proper moral attitude of wanting to do a good job aboard ship.

INFORMATION REGARDING SPILLS

I have just one other item that I would like to pick up in relation to Dr. Butler's presentation. Just before I came to this conference, I read a copy of *Ocean Industry*, in which I found an article by Dr. James N. Butler, entitled "The Largest Oil Spills: Inconsistencies and Information Gaps." It is an excellent article, and points out to me once again that when you put charts up on a wall and look at the specific figures, you must be careful with your statistics. You also have to careful that when you give statistics, the people who hear them understand the proper frame of reference. For example, in line with what Dr. John Robinson said about the misinformation prevalent relative to the *Argo Merchant* casualty and its aftermath, the helter skelter throwing around of statistics by the media, augmented by people who didn't know what they were talking about, led to the public's misinformation of what the effects really were.

PANEL PRESENTATIONS AND DISCUSSIONS

PANEL MEMBERS

Winona B. Vernberg, Chairperson
William M. Benkert
James N. Butler
James B. Ellis II
Robert S. Horowitz
John H. Robinson
Hal Scott
Anita K. Yurchyshyn

Robinson: I think I'd like to correct that last statement you made. I believe that the media in fact covered that spill very well.

Benkert: Well, I disagree strongly. I was interviewed regarding that case on television and various other places and there may have been some very good articles but some of the items that were quoted were untrue. I kept copies of the Washington newspapers which have an immediate bearing on what our government looks at. Some were pretty bad.

W. Vernberg: I think I'll ask the speakers to join us since they didn't have time to answer questions this morning.

Kiss: I have a couple of comments on Dr. Butler's presentation. There was some discussion about the effectiveness of LOT after his presentation, and my feeling on that right now is that it is a questionable area. Now that we have a TSPP convention, we're going to be getting into segregated ballast tanks on a substantial number of tankers. We ought to begin to look to the future on that. We've gone beyond LOT as the only solution we're going to see in our fleet. I was somewhat misled at first with John Robinson's stressing that the quantity of oil is not the important thing, but he then went back to clarify, at least for me, and brought out that, in fact,

it is important. He has arbitrary evaluation criteria which give it 10 points out of 100, but I think there are times when the quantity could be overrriding. The message I got out of his presentation was that we must continue to monitor the effectiveness of some of these new initiatives and recognize that in spite of training, in spite of design and construction standards, we're not going to be able to prevent accidents from occurring in the future. Another area that hasn't been discussed much so far that I think is really going to become important is the clean-up and control of spills and pollution as it occurs.

James Ellis: I'm Jim Ellis, the lawyer with the Coast Guard in Alaska and have been for the past three years through the establishment of the Vessel Traffic System in Valdez and the beginning of the tanker traffic up there. I don't really have much of a commentary on what was said in the way of pollution prevention. I would say that I think that Alaska has had a unique experience in the area of pollution clean-up in the past couple of years based largely on the initiative of now Commandant of the Coast Guard, Admiral Hayes, who began a very strong, cooperative effort in pollution clean-up between industry and the state of Alaska, the private sector and the Coast Guard, and it has worked so far beyond our wildest expectations and has proven itself to be a potentially very effective method of operation. I believe that that's the way we're going to have to look in the future. I don't think the day is going to come when the Coast Guard is going to have the resources to do everything we're charged with doing in pollution clean-up; the cooperative effort among everybody certainly seems to be the most effective and most efficient. I know that we have a unique situation in Alaska having only one state to deal with, but I recently had the opportunity to talk with several people from Massachusetts who were interested in the program and, in fact, have approached the state of Alaska regarding how the state has undertaken the participation in this cooperative effort, so I think that hopefully it will spread to other places.

Frankel: I was very interested by the papers this morning. I have a few comments to make, first of all with regards to the discussion of Dr. Butler and the LOT system. I am always somewhat concerned that we argue about numbers of effectiveness of the LOT system. Very little work is actually being done on the effectiveness of the LOT system. Its effectiveness depends on quality, the type of cargo, the temperature at which the cargo is unloaded, and the surface conditions. I must admit, we've attempted over many years to get people interested in helping us look at various types of non-clinging surfaces. Initial research has indicated that we could, probably, without too much investment, develop surfaces that are non-clinging: however, so far we have been unsuccessful in generating University funding to do this work. But we do feel that particularly, with regard to the LOT and the other similar types of systems, additional work has to be done.

The other comment I'd like to make is relevant to the discussion that Admiral Benkert had about crew training, liability, incentives

and so on. It is surprising that while we obviously do put flight recorders, for example, on every commercial aircraft, nothing similar has ever been considered on tankers. It wouldn't be too difficult or too expensive to use sealed containers that will indicate to us what the crew did and how well they followed operating requirements, sequences, and so on. Suppose we feel that such black boxes, while not wired up, would provide sufficient incentive for performance. You can give it some sophisticated name, and just provide the incentive. There are many aspects of this sort that I hope to give time tomorrow when I talk a little about technology, particularly the future potential developments in technology. We've had some recent experience, not on tankers, but on container ships, with what can be done to improve crew responsiveness by providing them more with both effective tools and more effective incentives, and they have been quite successful.

Hal Scott: I am Hal Scott, the President of Florida Audubon Society. Prior to becoming Chief Executive Officer of the Society, I spent 21 years in business. I know about your problems, I understand what it means to make payroll and a profit. I sympathize with you and I know where you are coming from.

Given that background, you may better understand my objection to Dr. Robinson's statement. I don't like to be categorized, and I don't categorize other people. The gentlemen with whom I've worked in the oil industry and the gentlemen with whom I've worked in the Coast Guard know that. I don't relish listening to Dr. Robinson toss off quips about conservationists which bear little resemblance to the truth.

This is a democracy and, despite all its imperfections, we still haven't found a better way of doing things. In a democracy when the public perceives a serious problem exists--regardless of whether the problem is real or imagined--the public is going to demand action on it. It is imperative if we wish to avoid unwise political decisions that the public be well informed. That means doing more than merely saying "*We* understand what's going on here. *We'll* solve the problem for you." That doesn't work anymore. Those of us who are not seafarers may not understand as much as you who make your living on the seas, but we understand enough to be able to ask some very meaningful questions and, I suspect, offer some worthwhile suggestions.

Any honest attempt to deal with oil pollution has to be predicated upon an understanding of the fact that we really don't know what the effects of oil pollution on our marine resources are. Anyone who thinks we do does not understand the parameters of the problem with which we are dealing. The fact is, we have enormous surplus of questions but few answers of value. I suspect that many important questions have not yet even been properly phrased. Given that absence of knowledge, we must seek constantly to minimize oil pollution from any source--not merely that emanating with tankers.

My own approach to dealing with the problem of tanker accidents is been summarized in a comment I made to the Senate Committee on Commerce in January 1977.

> In seeking ways to effectively control the operation of oil tankers and other vessels carrying hazardous substances in our waters, we would be well advised to keep in mind George Bernanos' observation that 'the worst, the most corrupting lies, are problems poorly stated.' If we listen to those who infer from the recent accidents that all foreign flag tankers are rusty tubs manned by imcompetents, that the Coast Guard is inept or uncaring, that the oil companies are irresponsible or that the cause of these tragedies can be readily ascertained and simple corrective action can enable us to avoid them in the future, we will be misled to our own detriment. What *can* be inferred from the recent rash of marine disasters is that our marine transportation system is archaic and is in need of prompt and thorough overhaul.

The more we look at the marine transportation system, the more we realize that accidents near our coasts and on our waterways are rarely caused by a single human failure, but usually result from long and complex chains of failures. At last, we are searching for methods by which we can break those chains and avoid accidents.

I think there is much we can gain from this conference if we avoid the temptation to respond with contempt to those with whom we disagree. Hopefully, we will deal with each other as sincere, intelligent individuals, each of whom views the operation of tankers from a different and unique vantage point.

W. Vernberg: Anita Yurchyshyn, Chairman of the Sierra Club Marine Environment Program, is a political scientist by training. She served as the London representative for the Sierra Club from 1973-1976, currently is an advisor to the environmental section of the United States Advisory Committee on the Law of the Sea, and is a member of the National Advisory Committee on Ocean Dumping.

Yurchyshyn: Marine Transport has been estimated to account for approximately one-third of the petroleum hydrocarbons introduced into the oceans. While up-to-date accurate estimates of each of the seven major sources of transportation-related pollution are not available, we do know that the actual amount of oil being introduced into the oceans from some of these sources is increasing. For example, the amount of oil introduced into the ocean from tanker casualties has more than tripled between 1974 and 1977, and 1978 is already much worse than all of 1977. Although arguments are sometimes heard that the number and percentage of casualties per tanker per year has declined, the fact of the matter is that the actual volume of oil being spilled from accidents is growing at an alarming rate. We must always keep in mind that what hurts our

environment is not percentages, but the actual amount spilled. There is now sufficient evidence to state that oil pollution from tankers is a real problem. We know that oil can kill marine life directly and that it may have numerous harmful indirect effects. Dr. Robinson has noted that there are many factors that determine the severity of effects resulting from oil spills and thus I will not catalogue them here. The least we can say is that oil spills are never a benign event; only the severity of their damage is subject to variance.

One of the questions addressed to this panel is what practical measures should be taken to reduce tanker pollution. The Sierra Club believes that there are viable regulatory approaches and standards which can be implemented that would go a long way toward bringing the oil pollution problem under control. Over the past five years the Sierra Club has advocated the following measures:

- the establishment of new standards for navigational equipment on oil tankers including electronic navigational aids such as Loran C, satellite navigational capability and a computerized collision avoidance system.
- the establishment of new standards for the design and construction of oil tankers. Under this category we have supported the incorporation of double bottoms and/or double hulls on new tankers larger than 20,000 dwt; gas inerting systems on all tankers larger than 20,000 dwt; and improved controllability of oil tankers through such features as lateral thrusters, controllable pitch propellers, twin screws/twin rudders, and back-up features to reduce tanker accidents when primary systems fail;
- we have also supported the establishment of adequate vessel traffic systems and services including but not limited to positive radar-controlled traffic system; vessel speed limits, escorts for oil tankers, and restrictions on movement during poor visibility in ports and waterways;
- we have worked toward improved standards for manning and crew qualification, especially in regard to instruction in vessel and cargo handling, license qualifications by specific class and size of vessels, and the development of standards to measure the qualification for licenses by use of simulators developed for the training of marine related skills;
- we have supported the updating and rationalization of the pilotage systems in the United States;
- we have urged the exclusion of substandard vessels

or tankers which have persistently violated pollution control standards from U.S. waters;
- we have advocated the establishment of standards for the repair, maintenance and alteration of older vessels--obviously an important factor as 85% of all tanker losses since 1974 were tankers over 10 years of age;
- we have promoted the establishment of a comprehensive data gathering program for tankers, particularly foreign flag tankers which trade in U.S. waters;
- we have worked to establish a comprehensive oil spill liability and compensation scheme entailing strict liability and an adequate fund to compensate those who suffer oil pollution damage;
- and, finally, we have supported increased funding and improved planning for contingencies in order to improve the effectiveness of the National Contingency Plan when, despite our best efforts at prevention, oil spills do occur.

This list is by no means exhaustive but is meant to reflect the comprehensive range of proposals that the Sierra Club has advocated to attempt to deal with both operational and accidental pollution. We have been promoting a systems approach which incorporates both measures designed to reduce the factor of human error--responsible for an estimated 85% of tanker accidents--and incorporate environmentally sound structural approaches to the problem of prevention of marine pollution from tankers. Both are needed; navigational errors will inevitably occur but improvments in the design, construction and equipment of vessels can help to compensate for errors once detected. And the investment in critical and expensive technical safety features must necessarily be followed up by the much smaller investment of time and money to ensure that the crews that are going to utilize that equipment not only know how to use it but also understand the reason for it being there. Extreme cases have been cited of certain crews failing to make use of the inert gas system on a tanker because they did not understand why it was there or because they did not know how to use it. While living in England we became aware of vessels steaming through the English Channel with thousands of dollars worth of electronic equipment simply not switched on. Clearly advancement in crew training must keep pace with advances of safety and pollution prevention technology.

One of the questions posed last night by Deputy Secretary Butchman involved the effectiveness of nongovernmental organizations and their activities. I have just outlined Sierra Club proposals in the tanker safety/pollution area, so now let's review how they have been received.

On March 17, 1977, President Carter issued a message to the Con-

gress concerning tanker safety and the prevention of pollution. Responding to the dramatic series of oil tanker accidents in or near United States waters, the President's initiatives focussed on the need for reform of ship construction and equipment standards. The President instructed the Secretary of Transportation to develop new regulations for oil tankers which would apply to all oil tankers over 20,000 dwt, U.S. and foreign, which call at American ports. The regulations included:

- double bottoms on all new tankers;
- segregated ballast on all tankers;
- inert gas systems on all tankers;
- backup radar systems, including collision avoidance equipment on all tankers; and
- improved emergency standards for all tankers. These standards were to be fully effective within five years.

Additionally, the President called for the improvement of crew standards and training; the development of a U.S. Marine Safety Information System and a Tanker Boarding Program; approval of comprehensive oil pollution liability and compensation legislation and the improvement of Federal ability to respond to oil pollution emergencies.

Several months later the Coast Guard proposed regulations implementing the Presidential initiatives. The Sierra Club applauded both these efforts and were gratified to see that almost everything we had proposed since 1973 had been accepted as United States policy. Unfortunately, the proposed rulemaking never was finalized. Instead, the United States used its best diplomatic efforts to win the support and adoption by the international community of equivalent standards at the February 1978 IMCO Conference on the Tanker Safety and Pollution Prevention. The U. S. did not succeed in this goal and the IMCO "compromise" falls substantially short of meeting the original U. S. objectives and the requirements of the proposed rulemaking.

In contrast to the proposed rulemaking, the IMCO compromise achieved the following: (1) double bottoms were rejected; (2) segregated ballast tanks (SBT) and crude oil washing (COW) will be required on new crude tankers over 20,000 dwt delivered after June 1982, but due to the present glut of tankers on the world market, there will be few new tankers constructed over the next ten years; (3) SBT will be required on new product tankers over 30,000 dwt, which will encourage shipbuilders to construct most product carriers slightly under that size; (4) SBT will be an alternative requirement along with COW for existing crude tankers over 40,000 dwt by June 1985, but that tonnage level excludes about 33% of foreign flag crude carriers and about 75% of U. S. crude carriers; (5) SBT will be required for existing product tankers over 40,000 dwt after June 1981, but that tonnage level excludes approximately 92% of existing product carriers; (6) inert gas will be required on all new crude and product vessels over 20,000 tons and on existing vessels over 40,000 dwt, but will not be required on smaller

tankers unless the ship has high capacity washing machines; and (7) collision avoidance equipment will not be required on any vessels until user standards are developed. The Sierra Club believes that the above are serious shortcomings.

In early 1970 IMCO reported that in light of the alarming rise in maritime casualties and pollution, "Urgent Action" was required to strengthen and improve standards and professional qualifications of mariners. Last June,--eight years after the call for urgent action--the first international conference on training and certification of seafarers was held. The Sierra Club recognizes this important first step and the adoption of the convention contains many laudible improvements. However, we feel that the transitional provisions of the convention are deficient, and that certain other matters affecting crew training are incomplete. The panel might wish to review these concerns during our discussion.

Finally, U.S. Coast Guard casualty figures indicate that over 6% of all tanker casualties are attributable to inadequate vessel maneuverability, yet this is one area in which neither IMCO nor the Coast Guard have proposed regulations. A MARAD (Maritime Administration) pollution abatement report has reviewed such features as lateral thrusters, controllable pitch propellers, improved rudders, twin screws and auxiliary braking devices and has concluded that they are workable, they are effective, and that they will result in significant pollution abatement. MARAD calculates, for example, that controllable pitch propellers would reduce stopping time about 20-30% over conventional ships. MARAD further calculates that an increase in rudder area will improve a vessel's stability index from 15-25%. The Sierra Club has suggested that such features should be required at least on U.S. Coast--wise tankers while some experts have already pointed out that if the *Amoco Cadiz* had been equipped with a set of lateral thrusters it might have been able to avoid foundering off the coast of France.

Fortunately, at least as far as the United States is concerned the U.S. Congress passed last month the Port Safety and Tanker Vessel Act of 1978, which goes at least one major and several minor steps further than the IMCO protocols. The major improvement is that SBT or crude oil washing systems must be installed in tankers of 20-40,000 dwt which will eventually catch approximately 77% of the U.S. Tanker Fleet and 72% of the foreign vessels using U.S. Ports. Furthermore, the new legislation clearly conveys the mood of the Congress that if the new measures are not sufficient, there will be tough new provisions that go well beyond the IMCO consensus. Section 6 of the Act clearly states that the Secretary of Transportation may issue differing regulations applicable to vessels engaged in the domestic trade, and may also issue regulations that exceed international standards.

In summary, one could say we have come a long way and the Sierra Club is pleased by the part it has played in developing public awareness and legislation bearing on the oil spill and tanker safety problem. However, we would be deluding ourselves if we did not briefly dwell on the question of timing. The international consensus and treaties that have been proposed are in many cases

years and perhaps even decades from final ratification by the requisite number of countries. In the meantime, we cannot reduce our vigilance and efforts to cajole rapid and broad compliance with the proposed international regulations even prior to formal ratification. The oceans may not be as timeless as human poliical debate.

Stanley: I direct my comments to the last speaker. I sympathize with the objectives of the organization which you represent. I detect a little pie in the sky, however, and perhaps a little lack of awareness of some realities out there. For years, the United States Government, as one government on the Planet Earth, this enclosed ecological system, has been trying to get American drivers to use some elementary safety factors in cars such as seat belts, and has been rather unsuccessful, I think. This is perhaps extraneous, but we simply cannot tell the world what to do in this. We need oil. We can control our bottoms, but there are not many bottoms flying the American flag which carry oil. We have to work in convention. The IMCO is one device, but we also have to be somewhat pragmatic; there is an economic factor out there. On the one hand, we're told that fuel costs too much. We have to keep our energy costs in line. On the other hand we're saying "Jack it up because we have to have a safety factor." Somewhere, hopefully, there's a happy medium, but perhaps there never is. I agree that the ocean is being despoiled in some fashion. You can have all the regulations in the world on "the books" and all manner of options for the Secretary of Transportation to use for regulating, but he's not going to implement these because we need this basic raw material. Furthermore, we don't produce enough ourselves to put into a pipeline to be kept away from the ocean, and yet still satisfy our demand for oil. The ocean is a medium which is fraught with danger. The *Titanic* showed us this, if anything else. You can have all manner of safety factors, but there's still an environment out there that is very hostile and it's a problem. I ask you to pursue your aims, by all means, but try to understand that not all things are possible in this realm.

Scott: I do not agree that we lack the power to bring about change. President Carter said he wanted significant modifications made in several international conventions. Sid Wallace set out to accomplish the President's goals and achieved far more than any of us thought he could. So I am not about to agree that we must do what the world wants. We have considerable political power that we can utilize. After all, we are a nation that buys enormous quantities of oil and, therefore, a much sought after market.

I do not and never did think for one second that all of our problems can be resolved tomorrow. But much of it can be made to happen within a relatively short time frame. Mike Benkert, Sid Wallace, and their associates, the Secretary and others brought about considerably more change than I think any of us really thought was possible at IMCO in February and then again at the most recent meeting of IMCO.

I reject the idea that the *Titanic* is an example of an accident

that could not be avoided. The *Titanic* is a good example of an accident that should never have occurred. The *Titanic* does not demonstrate that the marine environment is hostile. There are things at sea that can't be avoided, but the sinking of the *Titanic* was not caused by the environment. It was the result of human error.

Stanley: The use of the *Titanic* perhaps was improper on my part. We understand each other, I'm sure, in the context that no one disallows the fact that there are real problems with pollution. There's not a person in this room, I feel confident, who does not get a little uptight when he sees pollution, but I think that we are limited to some degree in a practical sense. We can pursue ideal aims, but there are practical limits simply because we cannot tell other people what to do anymore. Pax Americana doesn't exist anymore.

Scott: I disagree. I would suggest to you that many of the really difficult things accomplished in this country are brought about by a few souls who seek goals frequently viewed as impractical.

Yurchyshyn: If impact on policy is a measure of effectiveness, I feel we have been effective. The purpose of reviewing Sierra Club proposals has been to demonstrate that in March 1977, the President agreed with us, the Coast Guard agreed with us. If our proposals were totally theoretical solutions rather than practical measures, I don't think they would have advanced as far in the public policy forum as they did.

In terms of independent U. S. initiatives, this is one way of providing leadership for the world community. We feel that the U.S. has significant leverage and that U.S. standards have the potential of becoming effective international norms because so much of the world is petroleum is destined for U.S. ports. Also, 94% of our petroleum is imported by foreign world's flag tankers. So it is important that we act decisively in terms of such policies.

Now, in response to the questions of cost and economics, at the February conference, OECD estimated that the cost of retrofitting SBT for the world fleet and the incorporation of double bottoms on vessels would increase the consumer price of oil by no more than 1-2%. Similarly, the Coast Guard EIS on retrofitted SBT estimated the additional cost per gallon to be relatively small, approximately 0.2-0.6 cents per gallon. In regard to the cost of double bottoms, U. S. Shipyards have found that double hull tankers are being constructed at differential cost increases of approximately 3-5% over the capital costs of new single skin tankers.

Zacher: I would like to comment on Bill Stanley's dialogue with both Hal and Anita on Pax Americana. Basically, I think that my own study of IMCO politics, particularly of the oil pollution issue area, has indicated that during the 1970's, U.S. influence has certainly been phenomenal. I say this with respect to both the 1973 and 1978 negotiations. In fact, with the U.S. market for foreign oil increasing, and almost all tankers or a large segment of the world tanker fleet needing access to the U.S. ports, the leverage of the U.S. is

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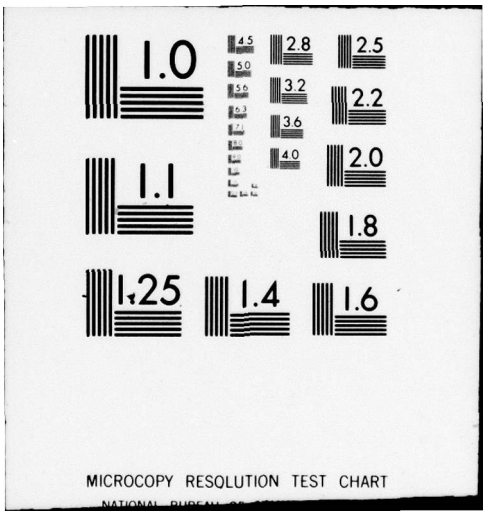
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really quite remarkable. Having said that, I also want to point out that in any negotiations, certain compromises are necessary and that any attempt by the U.S. to ram, lock, stock, and barrel, a complete package down the throats of other nations is seen as morally repulsive. In some ways, the environmentalists suffer more from an attachment to American hegemony than others, in that they often believe that they should be able to dictate completely what the world is to follow. I think that certain realizations are necessary that U.S. priorities are not always those of a large number of other nations and that in any international negotiations some compromises and sacrifices in what Americans would like are necessary--and even desirable.

W. Vernberg: May I exercise Chairman's prerogative here? I would like to know the economic cost of the *Amoco Cadiz* spill?

Yurchyshyn: I believe a claim of $300,000,000 has already been submitted by France for damage and clean-up costs.

Wiswall: The economic impact has to be measured, not only by the clean-up costs, also but by the effect upon the local economy in that part of France. The preliminary indications are that there was a net benefit to the local economy on the coast of France as a result of the spill. That sounds incredible, but if I can have a second, I will explain. It happened in March, out of the agricultural season. Every farmer, every lorry driver, every trucker that could be gotten hold of was hired with his machinery to come to the coast and transport cleaned-up oil away from the beaches. Vast numbers of people were brought in, both military and civilian. They were billeted in the hotels, which normally would have had no business at all at that time. There was a tremendous jump to begin purchasing and transporting to that area--food supplies and everything else right down the line from retail to wholesale. Local shopkeepers who had merchandise that hadn't moved in a very long time were suddenly sold out completely.

Benkert: I'm Mike Benkert. I would like to make a remark relative to Anita's statement and Mr. Scott's. I would like to preface this remark with simply this: some of you may or may not be aware that for roughly eight years, I was responsible for all of the Coast Guard's activity dealing with oil pollution, tanker designs, and so forth. I ran our Office of Marine Environment and Systems in the Coast Guard and the Office of Merchant Marine Safety. I was, in fact, the operating head of our delegation at the 1973 Pollution Convention and all of the 1977 and 1978 machinations leading up to the 1978 Tanker Safety Conference. I was also the head of our delegation from the United States at the recent Training and Watchkeeping Conference. So I think I have a very good feel for IMCO, its results, and the mechanics of functioning. I'll say this: The United States has had, and has, a tremendous amount of leverage in the IMCO forum. The United States is looked upon by

the IMCO family, if I can use that word, as a good, solid and morally courageous country in a sense of propounding policy thoughts, suggestions, and proposals in the IMCO forum for the international community. In connection with Anita's comments, particularly, and Hal's, over the years the Coast Guard got a tremendous amount of help in their efforts to fulfill United States policy in IMCO and nationally from environmental organizations. I personally have dealt with these two particular people over a long period of time. Their thoughts and ideas of pushing ahead are good. You do have to remember that you have to approach these subjects, whether you're going on an international basis or a national basis on a professional basis. You cannot look at things on an emotional, 'do everything at once,' basis. You've got to look at it on a professional basis of what you can accomplish in a particular period of time for the greatest benefit and what is saleable, particularly in dealing with IMCO. I think somebody mentioned that you have to be prepared in any international forum for some kinds of compromise. On the other hand, with relation to IMCO, take a look at how we have screwed up in the United Nations. In IMCO, we have made tremendous accomplishments for United States policy. In other United Nations bodies, we haven't even gotten a foul ball off the tip of the bat. I think that you must look at this professionally. You have to look at specifics professionally. For example, somebody will make a statement that bow thrusters will solve all the problems of the world. Bow thrusters will produce something at a particular low speed of a vessel depending on what kind of a mass of vessel you're talking about, but anybody that says, "you will put bow thrusters on a vessel going 20 knots, and it will turn around on a dime," is making a ridiculous statement. I have had some people tell us this. All I am saying is that when you make an environmentally oriented proposition or a proposal or you're pushing something, all that should be asked, I think, is "Is this professional, competent, feasible, and can we proceed?"

Naess: I'm Erling Naess. I lack the feeling that the accident problem is looked at in perspective. There is carried across the ocean 2,000,000,000 (two thousand million) tons a year. The *Amoco Cadiz* oil spill was 220,000 tons maximum. That is 1/10,000 of what is carried across the ocean safely every year. Add a few more accidents--1978--and the 1/10,000 will be somewhat corrected, but not very much. Accidents are bound to happen. You cannot help it. There will be human faults you can't avoid. You have an accident percentage of 1 in 10,000. Please keep it in perspective. The tanker industries do the best they can. If you are going to introduce Sierra Club's ideas, then I would like to know what are gasoline and oil going to cost in the end, if we're going to avoid accidents completely? You just have to keep it in perspective.

Scott: I have never been deeply concerned about the kinds of equipment ships possess. Instead, I have directed my attention to methods by which men operate them. Rather than saying, "You should use bow

thrusters or double bottoms," I have searched for the causes of accidents and asked "What can you do to prevent them." I remain convinced that what we need to do is to look for ways and means to break the chain of events that leads to accidents.

I don't think statistics belong in the picture. I am satisfied that the tanker industry does have a marvelous record, but it must be constantly improving that record.

Every time an accident occurs we must trace the events leading to it with great care, hoping to discover from it ways to help prevent future accidents. We may never stop accidents but we must continue to try to reduce the frequency with which they occur.

Yurchyshyn: I agree with Mr. Naess, we do need perspective. However, perspective is often a matter of vantage point. Perhaps the shipowner's perspective is more reassuring than the environmental one. Looking, in perspective, at tanker casualties over the past number of years we see, despite a decrease in the number of ships trading due to tanker lay-ups and in spite of technological and safety advances, that the actual volume of oil spilled is increasing. As I pointed out in my earlier remarks, the amount of oil spilled has tripled since 1974. Reciting percentages is not adequate. If fish could swallow percentages instead of ingesting oil, the ocean and its resources might not be threatened. We must be concerned with the actual amount of oil spilled.

Frankel: I certainly agree with Hal's earlier statement that it's not good enough for us to specify a large list of things that we believe ought to be built into tankers; we're not interested in hardware or changes in structural design, subdivision, or whatever, but performance. I wish that more of these factors were translated into performance requirements of ships. Another comment I'd like to make is, with all due respect to the work of IMCO, in my opinion, we look too much at ships as individual vessels, vehicles that have to be made safe on a one-by-one basis. Ships are part of a system. They depend on all kinds of things such as traffic control. Most spill incidents and even much of the operational spillage occurs close to coastal waters. We have over four million vessels in coastal waters at any period in time, a ten-fold increase over a 10-year period, if we take fishing, recreational vessels, platforms, and various other things into account. We have to look at better methods of communication. We have satellite communication systems. It's cheaper to improve the communication capability of a ship, its capability to predict weather conditions, and as a result improve its routing, than to install much of the hardware we've talked about.

We talked earlier about pollution and clean-up and so on. I know that there are all kinds of readiness programs, yet I'm still surprised at how long it usually takes after an accident to actually mobilize a clean-up or containment or the combination of containment, clean-up, and transference. It appears that we need to go through the exercise of developing a list of potential scenarios and programs for each.

Kiss: Ron Kiss, Maritime Administration. Just a comment. As I said earlier, I'm a naval architect, an engineer, then, by education. My orientation is to look for technological solutions to some of these problems. Anita went through a list of all the hardware that can at least point in a direction to minimize the consequences of accident or reduce the possiblity of accidents occurring. She then went on to say that this was a systems approach, and I'd just like to point out that I don't think that shopping list is a systems approach at all because if you apply ten separate solutions on a given ship or on all of our ships, and you do reduce the amount of pollution that goes into the sea, you really don't know why you did it or how you did it, yet it required some considerable economic cost. I think you have to recognize that the capital formation capabilities to construct ships in the world is extremely limited. It's extremely difficult to put together the finances that are necessary to build these ships. Perhaps the Maritime Administration, in some of the work we've done that she cited, has contributed to some of the problem. We did try to look at 20 or 30 technology alternatives to assess what their impact might be. What I'd point out is you can't take those and add them up and say, if you do all 20 of them, you eliminate all the pollution or all the risks that we said each one of them would eliminate because we'd probably end up preventing more pollution than actually occurs. The point is, if you have a collision avoidance radar and you have a controllable pitch propeller, they both might be an improvment but one of them might suffice and get all of the benefit. You don't necessarily need two of them.

W. Vernberg: Jim, did you want to say anything?

James Brown: Yes. Don't forget that most of the oil that goes into the sea goes in during normal operations and not during spectacular accidents.

Curlin: It ties right in. I wanted to get it in further perspective. We've been talking in the narrow sense of oil release, either by accident or by operational spillage, but what about the rest of the marine pollution? We may be talking here about a problem that is really small in proportion to the total problem. With respect to oil in the coastal region, when there is ocean dumping, the release of raw sewage, the accumulation of impact, what are we talking about in real terms of the oil release as *vis-a-vis* the total pollution load? Is it small, intermediate, or insignificant in relation to these other impacts? Does anyone know?

Unidentified Voice: We had a week-long workshop in Essex Park in June, which was directed at the question of priorities for marine pollution research, not necessarily for marine pollution control. The surprising thing that came out of that is that comparisons be-

tween different types of pollutants have not normally been made. That is, a sewage expert looks at the organic load from the sewage. An oil expert looks at the oil, but nothing else. An investigator in heavy metals research wouldn't care about the aromatic hydrocarbons from fossil fuel combustion. We don't have an integrated program of research on marine pollution and what we know about one pollutant generally doesn't correlate well with what we know about others. There was a program that Ed Goldberg and some other people put together called the "mussel watch" where they were going to analyze particular species of mussel from all over the world for a whole variety of different pollutants to see how things varied with time. The results of that program are still in the preliminary stages, so I can't really tell you what it's done. I think that I tend to get a little chauvinistic myself when I try to be unbiased because I'm working on oil pollution, but I got the impression that fossil fuel hydrocarbons or the generic kind of thing including the pollution from run-off, sewage, and atmospheric contamination, was one of the two or three most significant kinds of maritime pollutions.

Wiswall: Just two things. I wanted to finish answering a question that was asked earlier, about the cost of the damage of the *Amoco Cadiz casualty. What lawyers refer to as the "proveables" appear* likely to settle out below fifty million dollars. I can't now say just where. That does not take into account the hull loss, nor the loss of the oil, which is an almost infinitesimal figure in the economic damage calculation. This has to be set off against the local economic gains, not the least of which will be from the scientific and economic impact studies that will be conducted in France on this casualty for many years to come. Eventually, it may be possible to draw a line figure. It is going to be a final net loss figure somewhere in the millions of dollars which makes it a highly undesirable event from that purely economic point of view as well. Now, I just want to make a quick observation and ask a question. We're never going to reconcile the point of view of the fish and the ship owner. The perspectives are too divergent. I agree that there are bad ship owners. There are substandard ship owners. If you look at the problem from where I sit, there are no substandard *ships;* there are really just substandard *operators.* All of those ships could be either scrapped or brought into compliance. There are also substandard environmentalists, those who criticize without an understanding. And they are not the only critics that criticize without understanding. That's the other side of the picture. Now, when you are presented with a shopping list--and I've never had the opportunity before to hear as complete a presentation by the Sierra Club as the one this afternoon it helps those who are in the industry or those who are connected with it to understand and to appreciate which of these might realistically be adopted, if we can see what the price tag is and who's paying. This sounds like a hostile question, and I don't mean it to be, I'm really interested to know whether, in compiling all of these alternatives, consideration is given to cost, figures are evolved, and a method for meeting that economic burden is suggested

when these ideas are presented--because I didn't hear any of that in the presentation that was given.

Silverstein: This relates to the previous questions and it's really a fairly simple question that I've never been quite able to answer. Maybe someone here can help. Why aren't tanker technology, training standards, and so on tied more into the insurability of ships so that when a ship owner has to insure his ship, there's an economic incentive for him to lower his insurance rates by following certain standards? I've talked to some of the men in Lloyds', I've talked to people in different places, and I can't get a decent answer to that question.

Ellis: Jim Ellis. I just wanted to make two quick observations. One, Professor Frankel brought up--clean-up response and the time it takes to respond to oil spills. I think that for the federal government to effect an operation that can perform more quickly will require a price tag that people won't be willing to pay. In reference to something. I mentioned before, I think that the primary requirement to be able to respond to oil spills is cooperation among a variety of interests and agencies. In Alaska, we're an exception, certainly, but we're talking of response to spills in some places in terms of days, not hours. The price tag to respond more quickly is significant. One other thing I'll just point out ties in with what was said this morning on national energy policy. I think that we need to improve the standards on tankers; the effort we're undertaking is certainly a major step along the way, but I think that as long as we continue to increase the amount of oil we import, we're going to continue to increase the amount of oil we put into the ocean.

Yurchyshyn: I live in Boston, Massachusetts and would therefore like to comment on the *Argo Merchant* study which Dr. Robinson presented this morning. I don't wish to dispute its findings but rather inject a note of caution regarding the scientific quality of that investigation. Extreme weather conditions and logistical, institutional and other factors combined to hamper the efforts of the study. Scientists from Woods Hole and the University of Rhode Island who participated in the study have been very critical, not only of the results, but also of the planning, methodology, and type of sampling that was done. More recently, an MIT Sea Grant report (by Pollack and Stolzenbach) analyzed the *Argo Merchant* study and concluded that damage estimates were generally inadequate statistically and that the study suffered from other major shortcomings as well.

As far as acute biological effects are concerned, the *Argo Merchant* did impact the marine ecosystem. For example, copepods, the dominant zooplankton in the area, were found to be widely contaminated due to ingestion of the oil. Also, the biological data we do have indicated there were major effects on fish and larvae. Ninety-three percent of the pollock eggs sampled from one site near the spill were found to have oil globules adhering to

them and 98% of these eggs were dead or moribund. Pollock and cod embryos underwent 46% and about 25% mortality, respectively, throughout the large region covered by the slick. Scientists from Woods Hole have noted that dying fish eggs tend to sink to the bottom; therefore, actual egg mortality could have been considerably greater. The point is we don't yet know whether there will be long term damage to the fisheries in the Georges Bank area and to conclude otherwise is perhaps premature. The year class of damaged eggs will not grow to catchable size for at least three years. I think the jury is still out.

Carlton Russell: I'm Carlton Russell. I intend to use Dr. Silverstein's question as an entree. The one interest that seems to me to be perhaps lacking in this group is the marine protection and indemnity (P and I) underwriter himself, although we do have Mr. Hetzler here who places a lot of cover. I might say that in recent meetings in other locales, the answers were about as unsatisfactory as Dr. Silverstein has indicated. It's hard for me to understand how an *Argo Merchant* can sail for the New England coast without a functional LORAN or a LORAN whatsoever. When you compare the marshalling of resources that the underwriter does once the casualty occurs, what the requirements are for outfitting the vessel before it departs and still then has a reasonable chance of making the voyage, it seems to me you've got a very inordinate gulf.

Mr. Hetzler: Basically, your P and I underwriter has a policy that the vessel must be in a class, and if it isn't in class, the policy is automatically cancelled, and the underwriter doesn't have to give notice or anything else. The *Argo Merchant* presumably was in class, and therefore satisfied underwriter's requirements. I listened to a discussion between an owner and one of the P & I underwriters on just this point (whether more stringent inspections should be made by P & I Clubs) about a month ago in London, and the answer was that this club was starting to do something about this situation and was beginning to make inspections of marginal vessels. Over 90% of the world's tonnage is insured with the P & I clubs and it is obviously impossible for them to inspect every ship so they will have to continue to depend on the classification societies who in some instances don't appear to be doing their job. Obviously, when the P & I clubs make inspections they concentrate on the bad actors, the vessels that have had a lot of claims. I was told that prior to the pollution incident the *Argo Merchant* and the rest of this fleet had had a good record, so it probably would not have been the subject of a special inspection.

TOPIC C

POLLUTION PREVENTION INITIATIVES AND TANKERS

Sidney A. Wallace
United States House of Representatives
Committee on Merchant Marine and Fisheries
Washington, D. C.

This is Topic C, Pollution Prevention Initiatives and Tankers. I'm Sid Wallace. I have the advantage or disadvantage of being both the chairman and the first speaker on this program. Maybe I can put an overview on certain things that have been said. I'm the Maritime Policy Advisor to the Secretary of Transportation. I am an active duty Coast Guard officer, detailed to the Secretary's Office.

ABSTRACT: Protection of the Human Environment is a sensitive public issue in an age of mass media, and the political ramifications of the handling of this issue are formidable and complex. Important social values, e.g., the "quality of life", are involved with pollution problems. The American public has become deeply aware of and actively involved in pollution prevention issues. Nationally, there are many institutions, including government agencies, state and federal legislatures, industries, entrepreneurial businesses, and environmental organizations that engage in pollution prevention. Internationally, there are institutions such as IMCO involved in various aspects of pollution prevention. Depending on the resources available and the charter

and character of the institution, the capabilities and qualities necessary to effect pollution prevention vary widely. New tanker safety pollution prevention protocols resulted from the 1978 IMCO conference; IMCO as an institution has been extremely effective. Reaction in the United States to these new protocols has been, in general, favorable. The executive branch is moving quickly to implement the standards nationally and to ratify the protocols.

I'm Sid Wallace, the Maritime Policy Advisor to the Secretary of Transportation. I'm an active duty Coast Guard Officer detailed to the Secretary's Office. I've been in the environmental protection business for about 7 years and for about 4 years I was the manager of the Coast Guard environmental protection program working for Mike Benkert. I survived that to be Chief of Public and International Affairs for about a year and a half and then came to my present job. What I will present to you regarding my assigned subject is a highly individual view, perhaps irreverant in spots, drawing on my seven years involvement on both the national and international levels. I am speaking from notes--please bear that in mind when reading these unpolished remarks in the Proceedings.

INSTITUTIONAL INITIATIVES IN PREVENTING OIL POLLUTION

Central to a consideration of institutional initiatives in preventing oil pollution or protecting the environment from oil is an understanding that "Everybody wants to get into the act." This is certainly easy to explain: protecting the human environment is a sensitive public issue in an age of mass media. Furthermore, there are clear political benefits for those politicians who pursue environmental protection and there are political perils for those who neglect it. There are statutes that charge federal and state agencies with responsibility to initiate action with respect to situations like the *Argo Merchant* disaster. The responsbilities are often diffused and frequently overlapping, and some confusion is readily understandable. Public indignation or dissatisfaction with what is going on leads to the formation of action groups to press for visible progress. *"Action now"* tends to be the cry. People *do care* and the problems are real, although people may not understand the real problems. The problems of oil pollution are real; they are widely misunderstood; they are ill-defined in many aspects and no easy solutions exist that will satisfy all interests.

While we were preparing for the 1973 Marine Pollution Conference and defining the effects of oil discharged into the sea, the U. S. position tended to be: "pollution is guilty until proven innocent." We had at the opposite end of the spectrum the United Kingdom delegates, who wanted proof of harm before they would agree to any

standards that were higher than those existing. We won that argument in large part not through logic so much as through altruistic appeals in the name of the United States of America. Certainly there are important social values involved with pollution problems; "quality of life" is the popular phrase. Expectations tend to be high, but are often unrealistic because of the poor comprehension of all the factors that result in pollution. These factors include the realities of the transportation business, the vagaries of the weather to which ships are subjected, and other operational matters. Add to these the need for a constant energy flow to feed our voracious appetite for oil. These high expectations tend to be papered with impatience with delay in solving long standing problems that are deeply rooted in policy and practice. These expectations are laced with suspicion toward businessmen, bureaucrats, politicians, indeed toward the system in general. Americans typically like technological solutions. If we can send men to the moon, a luxury, we can build tankers that won't pollute, a necessity. Truly, ships can, through construction and design and training of the crew, be virtually pollution proof. We can construct a stainless steel ship, 1000 feet long, 200 feet wide, double hull construction, with crew trained to the standard of astronauts and carrying a thimble full of oil--if we are *willing to pay the price.*

The American Public likes to find scapegoats; that is, if something goes wrong, someone is to blame. The patterns of commerce, the evolution of technology, societal preoccupation with inflation and the cost of gasoline (the Proposition 13 mentality): these things can't be blamed for lack of progress. Agencies *can* be; individuals, bureaucrats and politicians *can* be; oil companies *can* be; the Coast Guard *can* be, and all of them *are* from time to time.

All these factors and more should be taken into account in considering the institutions that engage in pollution prevention. (Now I'm using institution in its wider sense, to include government agencies, branches of government, private organizations such as the environmental organizations, and businesses). Certainly the capabilities and qualities necessary to prevent pollution vary widely among these institutions. They equate to the resources available, to the charter and character of the organization, indeed to the reason for the existence of the organization.

The ability to gather and analyze facts varies widely. Informed opinion may be *required* of a government agency; it may be *desired* on the part of an environmental organization. Thus the government agency is in the position of being responsible for doing something, and the environmental organization, and for that matter, business and its lobbyists, are in the role of advocates. Political forces are applied by experts and are reacted to by those of us in government service on the receiving end. Professional judgement may suffer as a result. The system is vulnerable to political pressures, although this is our system, and it works well. Indeed, it is the most effective in the world, in my experience, at achieving social ends.

Economic factors are considered variously by institutions. Some

must consider them, some see them as beside the point and, sometimes economic considerations are outside the ambit of consideration, either by charter or by decision. We referred earlier to IMCO. Indeed the IMCO Charter does include an economic aspect which the organization may address, but a conscious decision was made early in the history of the organization not to do so. This has resulted in the creeping politicalization of the organization that was described this morning, as opposed to a faster process in other U. N. bodies.

Meshing the practical with the theoretical, the seafarer has a different view from the environmentalist. Perhaps it depends on the environmentalist and on the seafarer, but the two aspects always have to come together in the government agency in making final rules or passing statutes. The ability of an instituion, therefore, to formulate plans and laws depends on its place in the system.

OIL TANKER INITIATIVES

To illustrate institutional initiatives, implicitly if not explicitly, I want to deal with President Carter's initiatives of March 1977, from their inception to the present. The details of the initiatives have been discussed here in previous conversations.

The *Argo Merchant* and a number of other tanker incidents in the winters of 1976 and 1977 led to spirited Senate hearings in early January 1977. There was acromonious debate. There were statements that were somewhat overblown from our point of view, if not factually incorrect, and this was generally hard to take, as the Coast Guard felt it had been serving loyally and efficiently. On January 20 came the Inauguaration of a new President, who had campaigned as an environmentalist. I don't think his sincereity has been doubted in the least, although I know that there has been some criticism of the implementation of his policies. I do not comment editorially or otherwise on that. Nonetheless, he had identified himself as environmentally-minded and immediately after taking office formed an interagency task force in the executive branch, chaired by the Office of Management and Budget. A great deal of work was done in a very short time indeed; we were getting at least weekly, and in the latter stages, daily questions that came directly from the Oval Office about the status of our report. You must think back to the situation in which we found ourselves.

In handling and analyzing a great deal of data, perhaps more time would have been beneficial; however, circumstances did not allow that. There were technical considerations that probably became secondary in view of the urgency of the matter.

The President's Message on the 17th of March announced an interrelated set of measures designed to reduce the risks associated with the marine transportation of oil. I'm not going to detail these for you, but chiefly, with regard to tankers, they dealt with construction and equipment standards and certification and inspection practices. We were to proceed on two fronts: domestic and international. Domestically, we were to publish rules within

60 days, with the construction and equipment standards cited in the Message called out in regulatory language as a "notice of proposed rule making." The rules were subject to public comment, in accordance with the Administrative Procedure Act.

The State Department and the Coast Guard were designated by name in the President's message. Internationally, we were to proceed immediately with negotations leading to what the President hoped would be new treaties with improved standards for tankers, such as double bottoms, segregated ballast, inert gas systems, second radar, collision avoidance aids and improved steering standards. There was also a provision in the Message to this effect: where alternatives and technological improvements could be shown to provide the same degree of environmental protection or enhancement of safety, they were acceptable. That was our position both in our domestic regulations and before the international community from the time of the first announcement through the February conference.

Another institution asserted itself right after the President's message. The Senate Commerce Committee held hearings where Secretary Brock Adams testified; I was at his side in my then new capacity. Senator Magnuson, then Chairman, told the Secretary that he hoped that the Secretary would take a personal interest in this matter and follow it closely, including the make-up of U. S. delegations. He also asked the Secretary if he didn't think that legislation would be useful in additon to the President's message. My recollection is that the Secretary certainly did not argue on this point.

In May, two things happened: the Coast Guard published its proposed regulations within the 60 days, utilizing the standards in the President's message, and the Senate passed S.682, a very comprehensive tanker safety bill, which in *its* standards went well beyond the President's suggested standards. This was accompanied by a number of statements indicating that the Senator and his colleagues would follow our progress closely, which indeed proved to be the case.

Internationally, in April, Admiral Benkert, representing the United States, took the U.S. proposals to the IMCO Maritime Safety Committee. A month later Secretary Adams journeyed to London specifically to deliver the message from the President and ask for the cooperation of IMCO in negotiating new treaties, inluding setting up a conference as soon as possible. IMCO agreed, allocating the necessary funds and restructuring the IMCO work program to accomodate the required work.

Back to Washington: the conferences having been scheduled, the House of Representatives, in viewing S.682, agreed to wait for the outcome of the February conference before taking action. They, too, indicated there would be a close watch on our activities in preparing for and conducting the conference. That too proved to be the case. I might say that we in the Executive Branch welcomed this. We felt that the more exposure the Congress was able to get to what we were doing was to our benefit, because they would understand our problems better.

TANKER SAFETY

There were quite a number of technical sessions, special meetings on a final preparatory meeting in October. Mr. Butchman personally entered the scene on an international basis. He had been working closely with us and getting educated himself, having had little experience in the maritime world before he came to office. This participation meant that we had political officer involvement at both national and international levels, which proved to be immensely useful. I believe that this was the first time a cabinet officer from the United States had addressed an IMCO council and it was the first time that a subcabinet officer, a Deputy Secretary, had headed the U.S. delegation to IMCO.

THE TSPP CONFERENCE

The interagency preparation for the conference was rather intense. It included briefings for Congressional staff members, and representation from both industry and environmental groups.

Our delegation in February was made up of federal agencies including Coast Guard, Maritime Administration, EPA, NOAA and the Congress. We had environmental representatives (from the Center for Law and Social Policy); we had industry represented, and of course Alan Butchman was the U. S. Representative; Mike and I were his alternates. We had quite a large delegation. The shock troops were the Coast Guard personnel in the delegation; we knew there would be a vast number of technical meetings outside the conference rooms that would require people with expertise who were able to speak authoritatively for the United States on the points that we wished to make, and not yield where we were not in a position to yield. (In fact, all compromises were reached in private sessions with only Mike and me present).

At the conference we had delegations from 62 countries and a large number of non-governmental organizations accredited as observers. The conference lasted for two weeks. These were the most grueling international negotiations that either Mike or I had ever experienced. The days were extremely long; we worked right through the weekend; and we had innumerable private sessions. The conference was in danger of failing on a number of occasions when compromises or adjustments seemed impossible.

Because of some things that were said this morning I want to assure you that the influence of the developing countries was highly significant. We had visited a number of these countries and found a good reception, even where they did not agree with the U. S. position. We worked closely with them, explaining why we were doing what we were doing. They in turn explained their problems. They were definitely an influence in the outcome, and on balance, their influence was positive.

The developed countries found themselves distributed across the spectrum of positions on the issues, with the U.S. at one extreme and the United Kingdom at the other, which may not surprise

you. Out of all this came two protocols (treaties) plus some 15 resolutions, two of which were extremely crucial to the United States. The resolutions of the conference not only called out target dates for the protocols to come into force but invited governments to place the provisions of the protocols into force nationally to the maximum extent. That to us meant that the U.S. would act in accordance with the international agreements but would apply the regulations, before the protocols enter into force, to both foreign flag and U.S. flag.

On the 17th of February we adjourned, 11 months to the day from the President's Message, with two new treaties which went far beyond anything that had been previously agreed with regard to tankers. I can assure you that IMCO produced. To say that IMCO is slow is totally incorrect. If IMCO has the time it will be deliberate and very thorough, but in this instance it didn't have the time and it produced. The problem with treaties negotiated through IMCO is the ratification process with countries around the world, including the United States of America. We will, I hope, set a new record in ratifying these two protocols.

IMCO produced in the face of a heavy work schedule. In Europe a work schedule right through the summer is very difficult. Some of the countries actually have laws requiring the people to take three weeks leave, and they must take the leave in the late summer. Those people from Europe that were so afflicted, and people from the developing countries who had to travel a long way on a very limited budget, *produced*, notwithstanding the difficulties.

IMCO as an institution was effective. I'm delighted that this was recognized when we came back by both Houses of Congress in their comments on the results of the conference. The United States goals were, in general, achieved.

Remember, we were authorized to accept alternatives or technological improvements where they were equivalent in enhancement of safety and protection of the environment. We did so in the case of double bottoms by accepting segregated ballast located as protective space for new tankers. We accepted crude oil washing (COW) instead of mandatory retrofitted segregated ballast tanks because we were convinced that, given the mandatory procedures that were adopted at the confernce, COW would be as effective in reducing oil outflow as would segregated ballast. There were compromises made with regard to tonnages, specifically the 20,000 to 40,000 range of existing vessels.

REACTION IN THE UNITED STATES

The maritime press was very interested; they gave us fair coverage. Mr. Butchman held a press conference with Mike and me at his side. The press accurately reported what we said. The Congress, as I said, was complimentary. They said that we had done more than they expected and they would take a hard look at it before moving further. The results gained the approval of the Executive Branch; all the agencies that had been involved testified

in our favor. Some expressed regrets that we didn't get everything that we went over there for, but all came out in support of the protocols. There was testimony on the part of environmental groups to the same effect, specifically the Center for Law and Social Policy, which represents a number of groups, including Sierra Club and four or five others.

The states didn't seem to understand. Notable among them was Massachusetts, which subsequently circulated a petition, strongly urging that the original standards that had been proposed in the President's Message and others well beyond them be adopted by the United States, seemingly in complete disregard of what had been negotiated internationally. The State of Washington and the State of Alaska lost cases that had gone to the Supreme Court, where federal preemption essentially was recognized by the court as expunging large portions of existing statutes having to do with tankers passed by those states.

Back to the Congress as an institution: having taken a look at everything that happened back in February, the House of Representatives passed its version of S.682; subsequently S.682 became public law 95-474 and the President signed it into law about two weeks ago. There are some excursions in this new act, which is entitled Port and Tanker Safety Act of 1978, notably a provision that 15-year old tankers between 20,000 and 40,000 deadweight tons would be required in the year 1986 to have either crude oil washing or segregated ballast. This clearly goes beyond the TSPP standards; however, we have presented this matter to the international community and argued that a TSPP Conference resolution that calls for reconsideration of this issue, in effect in 1986, was merely anticipated by the Congress. In point of fact it is likely to affect the U. S. fleet more than the foreign fleet, if my understanding is correct.

There was a law case that the Center for Law and Social Policy had instituted to require the Coast Guard to publish final rules commensurate with those that had been published after the President's message (in other words, the original standards); the case had been delayed by the court pending conclusion of the international negotiations. The Center for Law and Social Policy petitioned the Court to reinstate its action and presumably was planning to litigate to have the original standards placed in effect, notwithstanding the results of the international negotiations. The Center eventually abandoned this action in the face of what had happened with the enactment of the Port and Tanker Safety Act of 1978.

We have been conducting an analysis of what could have happened versus what did happen in February and we have found, with respect to oil outflow, the TSPP solution is better than the original U.S. proposals, had they been adopted across the board internationally. Less oil goes in the ocean. We didn't know how wise we were.

I can assure you that the Executive Branch is moving quickly to implement the standards nationally and to ratify the protocols. The paper work is moving more quickly then ever before in my experience, and we hope to demonstrate to the world that we can be responsive, in light of our holding IMCO's feet to the fire for 11 months.

INSTITUTIONAL VAGARIES

If this were a lecture I could review the institutional roles that I have touched on. I won't. I think the institutional relationships are apparent. I *would* like to remark once more on the states: certainly the states, as I see their institutional role, are full participants with the federal government in formulating positions through the normal administrative process. This can be through head-to-head discussions that we are more than willing to have. Furthermore, we have plans to well underway meet with representatives of all the coastal states, explain what happened in TSPP, explain fully what's been happening in federal legislation, and answer a lot of questions as to issues not well understood. The states obviously have authority to pass laws that are not preempted by statute or the Constitution. Speaking as an individual, I cannot understand why state governments do not view international relations as the role of the federal government, and why a state would press for unilateral action in the face of everything that's happened just boggles my mind. Certainly the states are not in the position in which environmental groups and industry sometimes find themselves; i.e., pure out-and-out advocates. They too are a part of the government of the United States, and it seems to me that they should find within themselves the ability to recognize what the Constitution says about foreign relations and what our national responsiblities are around the world. This is not an attack, but I do find it disturbing. Hopefully our planned conferences with representatives of State governments will help us reach an understanding of their problems.

There is another institution brought up earlier that, I must say, I don't understand at all. I don't understand where the P and I clubs stand. I don't understand the function of underwriters in all this. I notice that whenever I try to go get information about what underwriters do, how they feel, what Lloyd's is doing, I run up against a brick wall. I just don't get any information and I don't know why. I'm sure there must be very good commercial reasons for it.

I have some odds and ends, then I will close. In my experience, industry can be moral, can be determined to do what is right, can be anxious to serve society as well as make money, just as others can be. All this takes into account the need to provide services on a sound business basis. I certainly speak as one who has been at odds with the industry spokesmen on many occasions at IMCO and intersessionally. I might say that the industry in the U.S. takes a very responsible position in their international relations at IMCO, more so than industry in some other countries.

We have referred to another point several times: people are the key. We can do all the construction and equipment standard making we want. The STW conference in June and July probably provided the best solution to our problems with tankers and other ships; this is a basis on which to build.

The conference took a gigantic step forward in an area where there has been virtually no international law. I'll close with

just a remark. When institutions interact to protect the environment it seems to me that striking a balance does not mean striking the battle flag.

Now I'm going to call on the next speaker. Mr. Trevor O'Neill, Acting Chairman of the California Interagency Task Force.

Trevor O'Neill: I'm Acting Chairman of the California Interagency Tanker Task Force. In a few minutes, I'll explain what that group does. I work at the Coastal Commission in California. We have a lot of activities going on off our shores and in our ports related to tankers. We have a lot of different state agencies doing different things that are related to tankers and in my half hour, I'm going to try to summarize for you what these activities are and explain to you some of the more important ongoing activities that we're dealing with today.

CALIFORNIA STATE ACTIVITIES RELATED TO TANKER SAFETY AND POLLUTION ABATEMENT

Trevor O'Neill
California Interagency Tanker Task Force
California Coastal Commission
San Francisco, California

ABSTRACT: Tankers and Tank Barges deliver and transfer approximately 3,000,000 barrels/day of crude oil and products in the waters off California. This total volume will increase in the near future as the Sohio pipeline comes into operation, as Elk Hills Naval Petroleum Reserve oil production enters the market, and as California's domestic production declines.

Several California State agencies are undertaking tanker-related regulatory actions. The Air Resources Board is developing regulations to reduce reactive hydrocarbon emissions from tank vessels, and to reduce sulfur oxide emissions from all vessels. The State Lands Commission has proposed regulations for marine petroleum terminals which would set stricter safety and pollution abatement standards than those currently enforced by Federal agencies. In addition, the Coastal Commission and the (San Francisco) Bay Conservation and Development Commission frequently attach tanker--and oil spill-related conditions to permits for marine petroleum terminals. An Interagency Tanker Task Force has been established to coor-

dinate the actions of 13 State agencies on tanker-related issues, and to convey California's interests, concerns and positions to Congress and Federal agencies.

Tankers operating in California waters include foreign-flag tankers importing crude oil from Indonesia and the Middle East, United States-flag tankers delivering crude oil from Alaska--not only North Slope crude from Port Valdez, but also crude oil from fields in Cook Inlet in southern Alaska--and United States flag tankers carrying crude oil and petroleum products between terminals in California and also from California refineries to Oregon. Tank barges are also in use, transporting products in the San Francisco Bay Area and along California's North Coast, as well as providing bunkers (fuel) to vessels in port, primarily in Long Beach and Los Angeles harbors.

On any given day, approximately 1,300,000 barrels of crude oil arrive in California ports from Alaska and foreign countries, and another 1,300,000 barrels of crude oil and refined products are loaded into tankers and tank barges for distribution along the coast. Some of the tankers importing crude oil to California are too large to call fully-loaded at petroleum terminals, and must lighter some or all of their cargo into smaller tankers or tank barges, either in port or in coastal waters. Hence, the actual volume of oil transferred in California ports and coastal waters is now close to 3,000,000 barrels per day. This total volume is likely to increase in the future as the Sohio pipeline comes into operation, as Elk Hills Naval Petroleum Reserve oil production enters the market, and as California's domestic oil production continues to decline.

Tanker problems fall into three main categories: *safety* problems, involving the loss of lives and property resulting from tanker accidents such as the 1976 *Sansinena* explosion in Los Angeles Harbor; *oil pollution*, intentional or accidental, which occurs both during routine operations and as a result of tanker accidents such as the 1971 *Oregon Standard-Arizona Standard* collision under the Golden Gate Bridge; and *air pollution*, especially the release of sulphur oxides and reactive hydrocarbon vapors--precursors to sulphate and smog formation--which pose special problems for California.

Efforts to provide for safer and less-polluting tanker operations must address a wide range of topics. Aboard the tanker or tank barge itself, improvements can be made in the design features of the vessel, its navigation equipment and operating procedures--at sea, in port, during transfer operations--and the qualifications and training standards of its officers and crew. At marine terminals, steps can be taken to upgrade the training and qualifications of the personnel directly involved in transfer operations, and to improve "normal" transfer procedures in order to avoid the recurring oil spills which have plagued several California terminals, especially in the Bay Area. Other areas in which improvements can

be made include pilotage and tugboat assistance procedures, vessel traffic routing measures, port planning and risk management practices, and government inspection, communications, monitoring, and enforcement capabilities.

Jurisdiction over various tanker-related activities has been vested in a large number of separate government agencies at the local, regional, state, federal, and international levels. This fragmentation greatly complicates the task of regulating tanker operations effectively and efficiently. In California, there is no state agency with overall responsiblility for tanker operations in particular, or for maritime affairs in general. Nor does California have a state-level counterpart to the U.S. Coast Guard. As a result, numerous state agencies with separate proprietary interests, permit, regulatory, and planning powers or responsibilities may participate on an *ad hoc* basis in any given state action involving tankers.

The Coastal Commission and the (San Francisco) Bay Conservation and Development Commission (BCDC) have direct permit authority over virtually all development proposals along the California coast, and approval by one of these two agencies would be required for any new petroleum terminal or other tanker-related facility in California's coastal zone. The Air Resources Board (ARB) has responsibility for abating California's air pollution. The ARB is now developing rules aimed at reducing tanker reactive hydrocarbon and sulfur oxide emissions in California's coastal waters. The State Lands Commission is preparing regulations to improve safety standards and pollution abatement procedures at marine petroleum terminals in California.

Other state agencies which might be involved in tanker-related actions are the Attorney General's Office, Department of Fish and Game, Department of Navigation and Ocean Development, Department of Transportation, Division of Navigation and Ocean Development, Division of Oil and Gas, Energy Resources Conservation and Development Commission, Governor's Office of Planning and Research, Public Utilities Commission, Resources Agency, and the State Water Resources Control Board. At the local level, port or harbor authorities, pilotage boards, fire departments and other agencies exercise a variety of controls over tanker operations in California ports.

In October 1977, Resources Secretary Huey Johnson created the California Interagency Tanker Task Force, at the request of nine members of the California Legislature, in order to:

- coordinate information and actions of state agencies regarding tanker-related issues;
- monitor the administrative, legislative and judicial activities of the Federal government with respect to tanker-related issues;
- communicate California interests, policies, and positions to Federal representatives; and
- identify and study tanker-related issues, and recommend appropriate legislative and administrative actions.

The Tanker Force consists of 24 members representing 13 State agencies, the Assembly and Senate Offices of Research, and includes several representatives of interested legislators. The Task Force has prepared a report, now in press, which should be publicly available in the near future. The report contains a series of findings and recommendations, divided into three principal subject areas: tanker operations; terminal and port operations; and oil spill cleanup and liability. In this paper, I will use the same subject groupings to describe State activities in California related to tanker safety and pollution abatement.

TANKER OPERATIONS

The United States Supreme Court's *Ray vs. Arco* decision last spring largely preempts States from enforcing tanker construction, design and equipment standards intended to protect the marine environment from oil pollution which are stricter than those set by the Federal government. For this reason, the Task Force directed its tanker construction, design, and equipment recommendations at Congress and the U.S. Coast Guard. The Task Force has recommended that all U. S.- flag tankers be required to possess segregated ballast capacity, crude oil washing systems, inert gas systems, redundant steering gear and radar, and collision avoidance systems.

In achieving the segregated ballast capacity, the Task Force distinguished between new and existing tankers. For *new* tankers, the Task Force concluded that a double-hull configuration would be economically feasible, and therefore recommends that all *new* U. S.- flag tankers be required to be built with a double hull. For *existing* tankers, though, the retrofit costs would be substantially greater, and the expected working lifetime during which the capital cost of the retrofit could be recovered would be shorter. For these reasons, the Task Force concluded that *existing* tankers should not be required to retrofit double hulls, sides, or bottoms to meet the recommended segregated ballast requirement.

On a related point, the Tanker Task Force has recommended that the U.S. Coast Guard compile casualty and oil spill statistics comparing the performance of tankers with double hulls, sides, bottoms, or protectively-located segregated ballast with tankers lacking such features, and publish the results on a regular basis.

Electronic devices are increasingly used aboard vessels of all kinds to assist in both vessel operations and navigation. Transponders, LORAN-C retransmission devices, trip recorders, and other electronic "black boxes" have been conceived or developed in recent years which promise to improve existing vessel navigation, position-fixing, and monitoring capabilities. These and other such electronic devices, though, share a significant drawback--their practical value has not been established, primarily because there has been no comprehensive field testing program to gather information based on actual shipboard and shoreside use.

The fleet of tankers carrying Alaska North Slope crude oil from Port Valdez to the U. S. West Coast constitutes an excellent test population for conducting experiments and gathering information on these and other promising electronic devices. These tankers are all under complete U. S. control, they are operated by and on behalf of major American oil companies with substantial tanker fleets and tanker experience, and most of them will be shuttling back and forth between and among the same ports for the next decade or more.

The Task Force has therefore recommended that the Coast Guard conduct an agressive field research and development program to determine the present value and the potential value of such electronic devices as transponders, LORAN-C retransmission devices, and trip recorders. As part of this effort, the Coast Guard should solicit the cooperation of the Port Valdez-U.S. West Coast tanker fleet to conduct appropriate field tests, experiments, and demonstrations.

One issue raised by the *Amoco Cadiz* disaster is the availability of tugs or other suitable vessels to assist disabled tankers off California's coast. Ocean-going tugs are available in the Bay Area and the ports of Long Beach and Los Angeles. In addition, U.S. Navy tugs are stationed at Port Hueneme and San Diego. Coast Guard vessels, as well as supply boats serving offshore drilling rigs and production platforms might also be pressed into service during emergencies.

The Bay Area and the coast south of Point Conception appear to be adequately covered, but the central and northern California coast may not be. The Task Force has recommended that the Coast Guard identify vessels along the central and northern coast capable of assisting tankers in distress, and take whatever steps are needed to ensure that these vessels can be located and dispatched promptly during an emergency. Moreover, the Coast Guard should consider designating new vessel traffic routes farther offshore in order to increase the time available to assist a disabled tanker before it reaches shore.

Air pollution is of particular concern to California, in large part because existing air quality problems in urban areas along the coast are so severe. California's Air Resources Board is developing several regulations which address vessel contributions to California's air quality problems. One regulation under consideration would reduce vessel emissions of sulfur oxides by imposing a low-sulfur fuel requirement on all vessels which call regularly at California ports. Such a regulation would affect many of the tankers and other vessels operating off California.

Another proposed set of regulations aimed specifically at tankers would sharply reduce emissions of reactive hydrocarbons--precursors to smog formation--in a designated portion of the waters off California. In order to comply with the proposed standards, tankers would have to either cease lightering, tank purging and gas-freeing operations within the designated waters, or develop equipment and procedures which would reduce the reactive hydrocarbon emissions to permissible levels.

TERMINAL AND PORT OPERATIONS

Section 102(b) of the Ports and Waterways Safety Act provides State and local governments with the authority to set higher safety equipment requirements and safety standards for structures such as marine petroleum terminals than those set by Federal agencies. In the past, State and local authorities have generally been content to rely upon Federal terminal standards and requirements.

In recent years, though, State agencies in California have become concerned that these Federal regulations are not as effective as they ought to be in achieving safe, pollution-free terminal operations. Reflecting this concern, agencies with permit authority over petroleum terminal operations, primarily the Coastal Commission, have begun attaching conditions to terminal permits which impose new or more stringent State requirements on terminal operators.

The State Lands Commission has issued proposed regulations which would require terminal operators in California to develop and submit for approval a terminal operations manual, to undergo periodic inspections by State Lands Commission staff, to develop contingency plans for fires, explosions, earthquakes, oil spills, and other emergencies, and to take other actions.

Present Coast Guard regulations require that all oil transfer facilities have "ready access" to oil spill containment equipment, and define "access" to mean direct ownership, joint ownership, cooperative venture, or contractual agreement. Some terminal operators store and maintain oil spill containment boom at the facility, although this is not now required. Other terminal operators have no equipment at the facility itself, and have arranged for booms and other spill response equipment to be delivered to the terminal in the event of a spill. This practice can build unnecessary delay into spill response, and may needlessly reduce the effectiveness of containment and recovery efforts.

Several State agencies are now imposing permit conditions which require terminal operators to maintain oil spill containment boom and recovery devices at the terminal facilities. In certain cases, more stringent requirements are being imposed. In 1976, the *S.S. Hawaiian,* a bulk carrier for the Matson Line, was involved in two oil spills in the San Francisco Bay Area--one in Oakland Harbor and one in the Carquinez Straits. Both spills occurred while the ship was loading oil, and both happened because the cargo tanks were permitted to overflow. The Attorney General filed suit, and obtained a negotiated settlement under which Matson will take special precautions during future operations.

For transfers anywhere in the Bay Area except in the Carquinez Straits, Matson will hire an independent pollution consultant to supervise and monitor all transfer operations, and will surround the receiving vessel with oil spill containment boom. In the Carquinez Straits, which have valuable marshes at each end, and where currents are often too fast for booms to contain spilled oil

effectively, Matson will have the independent supervisor/monitor present at all transfers, and will have booms and skimming devices on a work boat standing by in hopes of diverting and collecting oil in the event of another spill.

Existing Coast Guard regulations require that the person in charge of oil transfer operations at a petroleum terminal have at least 48 hours of experience in oil transfer operations, and that this person be familiar with the terminal operating procedures, control systems, contingency plans, and Coast Guard regulations applicable to oil transfer operations. However, there is no experience or training requirement for any other members of the terminal crew engaged in a transfer operation. Some terminal operators voluntarily provide training for such personnel, while other operators do not. The State Lands Commission is moving to set minimum training standards for all workers directly involved in transfer operations, because any of them may be in a position to cause or prevent oil spills, fires, explosions, or other accidents.

A bill was recently signed into law in California which makes it unlawful to transfer oil or other hazardous substances between a vessel and a shore facility or another vessel through a pipeline, unless the flow is continuously monitored by a mechanism which will warn of the imminent occurrence of an overflow in time for the flow to be shut off before spillage occurs. The Tanker Task Force has recommended that the U. S. Coast Guard consider using its existing authority to impose such a requirement on a national basis.

The hazards associated with the handling, transfer, and storage of toxic, flammable, or explosive materials in U.S. ports have received increased attention in recent years. Facilities handling such materials are generally required to prepare contingency plans for a response to catastrophes such as fires, explosions, earthquakes, etc. However, the potential scope of a major disaster could exceed the resources available to individual facility operators for response to such an event. With regard to massive oil spills, industry cooperative associations have been established in most major California ports to share spill response equipment. Other potential disasters have received less attention.

The Coastal Act of 1976 requires the ports of Long Beach, Los Angeles, Port Hueneme, and San Diego to develop and submit master port plans for certification by the Coastal Commission. As part of this effort, the ports of Long Beach and Los Angeles have initiated risk management programs, consisting of three phases: an inventory of existing hazards; an assessment of the degree of risk associated with each hazard; and development of prevention and mitigation strategies. Each port has begun work on the first phase, with funding provided by the Coastal Commission through the Coastal Energy Impact Program.

OIL SPILL CLEANUP AND LIABILITY

California has never experienced an oil spill on the scale of the *Argo Merchant*, *Amoco Cadiz*, or *Torrey Canyon* disasters. The

largest tanker-related spills in California waters to date have been the 1971 *Oregon Standard - Arizona Standard* collision underneath the Golden Gate Bridge and the 1976 *Sansinena* explosion in Los Angeles Harbor, each of which resulted in oil spills of about 20,000 barrels. The largest recorded oil spill from any source in California is the 1969 Santa Barbara Channel blowout, which was estimated by Federal officials to involve 77,000 barrels.

Almost all oil spill containment and recovery equipment in California is owned by private companies, either individually or through cooperative associations. There are five such cooperatives in California, based in Humboldt, San Francisco Bay, Santa Barbara, Los Angeles, and Long Beach harbors. Most of this containment and recovery equipment, and virtually all of the equipment suited for open ocean work, is stored in the Bay Area and in Southern California. This pattern reflects the historical concentration of oil production, transfer, and storage activities--and thus the most frequent opportunities for spills--in these areas.

Tankers operate along virtually all of California's 1,000 mile coastline. A major tanker oil spill could occur at any time, and the potential size of such a spill is enormous. The Santa Barbara Channel blowout released less oil than is carried in a T-2 tanker, one of the smallest classes of tankers in service off California. Tankers now being built for the Port Valdez-California trade are as large as 188,000 deadweight tons. Should one of these fully-loaded tankers break up off California and release all of its cargo, the resulting spill would be more than 15 times larger than the 1969 blowout.

North of San Francisco, the Alaskan tanker routes generally lie 100 miles or more offshore, so that if a major spill occurs there, sufficient time would probably exist to deliver containment and recovery equipment from San Francisco before the oil could reach shore. South of San Francisco, though, the tanker routes generally lie close to shore, so that spilled oil from a tanker casualty could move ashore more rapidly. There is almost no heavy-duty oil spill containment or recovery equipment now located along the coast between Monterey and Point Conception, so the central coast region would appear to be the least protected portion of the California coast threatened by major spills from tankers.

President Carter's message of March 17, 1977 directed the Coast Guard and EPA, in cooperation with State and local governments, to improve existing oil spill containment and response capabilities, with the goal of achieving the ability to respond within six hours to a spill of 100,000 tons. The Task Force has recommended that the Regional Response Teams for Coast Guard Districts 11 and 12 should seek to establish a minimum response capability for the entire California coast, but should place special emphasis on increasing response capability for the central California coast from Point Conception to Monterey.

There is no entirely satisfactory method of evaluating the adequacy of an operator's preparations to deal with an oil spill other than to observe the response to an actual spill. The three oil spill cleanup cooperatives in Southern California which will

be called out during a major oil spill were established after the 1969 Santa Barbara Channel blowout. With the exception of the *Sansinena* spill--which occurred at dockside and involved heavy oil which sank to the harbor seafloor--there has not been a major spill off Southern California since 1969. Hence, the ability of the three Southern California cooperatives--Clean Seas, Inc., Clean Coastal Waters, Inc., and the Southern California Petroleum Contingency Organization--to respond effectively to a major oil spill emergency has yet to be demonstrated in the field.

State agencies with permit authority for petroleum terminals have begun to attach conditions requiring the operator to respond to unannounced simulated oil spills. In these exercises, a series of assumptions are made regarding the size and characteristics of a hypothetical spill, the terminal operator is notified that an oil spill with those characteristics is assumed to have taken place at a designated location, and the operator's response is observed, timed, and analyzed. To assist in tracking the movement of the hypothetical oil slick, nontoxic floating material is released at the site of the assumed spill.

Three such response drills have been called to date in accordance with terminal permits issued by State agencies. Some problems have arisen in judging the overall adequacy of an operator's response, in identifying specific components of an operator's contingency plan, including equipment, personnel training programs, and the field response itself, where improvements need to be made, and in following up to ensure that needed corrections are made. In one such exercise, the State, Federal, local and industry observers appear to have reached significantly different conclusions regarding the caliber of the operator's responses, and such corrective actions or improvements as might need to be undertaken.

However, California intends to continue this program for two principal reasons. First, it assists State, local and Federal representatives to determine the actual oil spill response capabilities of terminal operators. Second, the learning curve for oil spill cleanup operations is quite steep, and California prefers that errors, faulty assumptions, and contingency plan shortcomings occur or be identified during such practice exercises, rather than during a genuine oil spill emergency when the penalty for mistakes is much greater.

The Attorney General's Office assists county District Attorneys in pursuing criminal and civil actions against oil spill violators. In a recent policy change, the Attorney General's office has begun to indict and prosecute the individual whose actions or inactions result in an oil spill, rather than the corporation employing the individual. This practice is expected to have a salutary effect on the incidence of spills resulting from negligent or incompetent actions.

With regard to oil spill liability and compensation, California supports the enactment of Federal Legislation which:

1. sets a uniform standard of strict liability without regard to fault;

2. provides adequate compensation for quantifiable and unquantifiable damages;
3. does *not* preempt State oil spill liability legislation;
4. prohibits double recovery for the same damages; and
5. permits a claimant to proceed directly against any spiller, including a spiller who denies or disputes liability.

In summary, tanker safety and pollution abatement issues are of great concern to the State of California. A number of separate State agencies are pursuing permit, regulatory and planning efforts aimed at accommodating activities off our shores with both the necessary efficiency and the necessary margins of safety. California's coastal and marine resources are used by millions of citizens for many purposes. The levels of use, and the conflicts between and among uses, are going to increase in the future. Providing for these uses, and resolving conflicts in a manner which strikes the best balance among conflicting private, local, state, and national interests will require hard work, patience, sustained commitment, and an unusual degree of coordination and cooperation among the many public and private interests involved. California intends to work constructively with all interested parties to achieve the twin objectives of tanker safety and pollution abatement.

Wallace: Our next speaker is Mr. Robert McManus, who will provide his own introduction.

THE ENVIRONMENT AND NAVIGATIONAL FREEDOMS

Robert J. McManus
Surrey, Karasik and Morse
Washington, D. C.

ABSTRACT: Environmental regulation poses a substantial threat to traditional navigational freedoms, as reflected in the ancient doctrine of "Freedom of the Seas." While the United States has been a staunch adherent of that doctrine in international fora, it has frequently taken unilateral legislative actions that have tended to undercut its legal position. Absent a clear statement of jurisdictional ground rules in a Law of the Sea Convention, coastal states, including the United States, will predictably continue to extend their environmental jurisdiction further seaward. The author analyzes specific actions they might take in this regard, and suggests that commercial and environmental interest groups both take a more reasoned approach to such questions in the future. More particularly, the environmental community is asked to withdraw its support of jurisdictional extensions that will have no practical environmental benefits, and the maritime community is asked to limit its opposition to such extensions that will truly impede commerce.

It is indeed a pleasure to be asked to provide my own introduction. I am Counsel to Surrey, Karasik and Morse in Washington. You might wonder, then, what I am doing here, speaking on this subject, and so I thought I should explain. After graduating from law school in 1968, I spent three years with Surrey, Karasik and Morse, then went to the Environmental Protection Agency, where I was in the office of General Counsel for three years. In 1974, I became the so-called Director of the Oceans Division in the Office of International Activities. I was, in actuality, the Agency's treaty lawyer and, in that capacity, got to serve in a number of wonderful road shows. I was on Mike Benkert's delegation to the 1973 MARPOL negotiations. I was present at the creation of the 1972 London Ocean Dumping Convention. I spent the bulk of my time, however, as an Alternate U.S. Representative to the Law of the Sea negotiations, beginning in Caracas and continuing until I resigned from the Agency in October, 1977. (I will omit the part about my formative years.) I might also mention what was probably the low point of my career: I served on the Oil Pollution Task Force previously alluded to by Sid Wallace, and I have a form thank-you note from Bert Lance with respect to that activity.

During my government years, I participated in two great public policy debates. The first was the one that I heard replayed in the last session. I can't resist the aside that sometimes you think there ought to be a definitive answer. You hear the Sierra Club on the one hand and Intertanko on the other hand, and you think there must be an answer. But of course there isn't; there's only creative tension. There's an environmental interest, and there's a navigational interest, but, I suppose, there's no definitive answer. It took me a while to discover that when I was in the federal government, worrying about IMCO and EPA's relationship to it.

The other great debate is the subject of my present remarks on environmental protection and freedom of navigation. This great debate transpired, for the most part, in the course of the Law of the Sea discussions, to which I will turn in due course.

THE HISTORY OF NAVIGATIONAL FREEDOM

"Freedom of the Seas" was advocated by a 17th-century Dutch jurist named Hugo Grotius. As I understand the doctrine, it means that the high seas are incapable of being subjected to sovereignty by a coastal state, and you can do pretty much what you want out there, having reasonable regard for the interests of others that might be affected. The doctrine of Freedom of the Seas has never been an absolute, apparently. I was surprised to read recently that before the time of Grotius, the British used to pay tolls to get through the Skageratt to Denmark. On the whole, though, it has been a fairly well-preserved doctrine, and it has been regarded as important for two essential reasons: commerce and national security. It is important to be able to move goods around the world's oceans. In the context of this conference, it is important to move oil, and, more specifically, oil by tankers. With respect

to national security interests, I don't believe I need elaborate. I think it's obvious that there is such an interest, although there has been a spirited academic debate on the degree of importance of freedom of navigation to national security interests, especially as it relates to transit passage through straits. But in any event, there are clearly solid policy underpinnings for the doctrine of Freedom of the Seas, as it has been espoused by the United States and other maritime powers in recent centuries. It has not been seriously questioned, I do not believe, until fairly recently.

After World War II, though, something happened. President Truman learned that there was oil on the outer continental shelf. He issued a Presidential Proclamation, stating the position that the mineral resources of the outer continental shelf (being the natural prolongation of the land mass) appertained to the coastal state. Nobody really minded. Indeed, the functional equivalent of the Truman Proclamation eventually found its way into conventional international law in the form of the 1958 Convention on the Outer Continental Shelf. But it has been suggested by a number of legal historians that the Proclamation gave rise to more energetic coastal state claims--such as those by Chile, Ecuador and Peru, who claimed 200-mile wide territorial seas, in which they asserted plenary authority to regulate vessels and, of course, management authority with respect of fisheries. More recently, we have seen some environmental pressures coming to bear on the doctrine of Freedom of the Seas, the most common example being Canada's Arctic Waters Pollution Prevention Act, which was passed in 1970 to the dismay of our State and Defense Departments. Under that Act, Canada purported to regulate tankers within 100 miles of her fragile Arctic coastline north of 60° N latitude, plainly an interference with the doctrine of Freedom of the Seas as we had theretofore understood it.

A further exception to the notion of total navigational freedom has been the coastal state's authority in the territorial sea. The territorial sea was traditionally three miles wide, presumably because that was the area within which a coastal shore battery could assert sovereignty. But the three-mile limit is creeping outward. The United States and a few other maritime powers are hold-outs: we still think that our territorial sea is only three miles wide, but we are in a distinct minority, and there are some very interesting statistics showing how territorial seas have been getting wider and wider over the years. Stimulated, then, by a fear of what is generally called "creeping jurisdiction," we got involved in the Law of the Sea negotiations.

Hence, the second of the great debates to which I have alluded and in which I have had the pleasure of participating.

My suggestion this afternoon is that the cause of environmental protection is probably the greatest threat to freedom of navigation, as we have known it. Why? In the first place, there has been a public outcry. You've heard about that today. I was interested in John Robinson's talk this morning about public reaction to the *Argo Merchant* disaster. I will not get involved in the debate as to whether or not that reaction is reasonable or hysterical, but

there clearly has been public outcry. Second, I cite Admiral Wallace's remarks about politics. After the *Argo Merchant*, there were some truly zany legislative proposals that showed up in the United States Congress. I suppose that not even their proponents expected them to get very far, but they were absolute anathema to the State and Defense Departments, and to the people charged with prosecuting our national security interest through exercises such as the Law of the Sea negotiations. Third, coastal states have a legitimate economic interest in protecting themselves from oil pollution. In any case, customary international law can and does change over time, and I expect that it is changing in this area. And, some environmentally-attuned regulations could constitute substantial interference with international shipping.

THE RECENT U.S. RECORD

While the United States has always been in favor of navigational freedoms in international fora, I would suggest that the behavior on the subject of our legislative and executive branches has been schizoid; I think we may be slipping from the fold of those who believe wholeheartedly in the doctrine of Hugo Grotius. I have several examples:

— The first, fisheries, is unrelated to pollution. Access to fisheries used to be considered a high seas freedom. Although the coastal state had an exclusive right to manage and harvest the fisheries resources of its three-mile territorial sea, our own exclusive fisheries zone went rather quietly from three miles to twelve miles in 1966. Of course, that extension pales in comparison with later developments, but I want to read to you the text of the relevant article from the 1958 Convention on the High Seas:

> "The high seas being open to all nations, no state may validly purport to subject any part of them to its sovereignty. Freedom of the high seas is exercised under the conditions laid down by these articles and by the other rules of international law. It comprises, *inter alia*, both for coastal and non-coastal states:
>
> (1) freedom of navigation;
> (2) freedom of fishing;
> (3) freedom to lay submarine cables and pipelines; and
> (4) freedom to fly over the high seas."

A subsequent clause says that "use of these freedoms shall be exercised...with reasonable regard to the interests of other states...." Thus, "freedom of fishing" was clearly included, and we took the position, in 1966, that the nine miles between the three-mile limit and the twelve-mile limit, although designated as a "contiguous zone," were also "high seas" within the meaning of

the 1958 Convention. Nevertheless, out crept our fisheries jurisdiction.

— Then, of course, we enacted the Fisheries Conservation and Management Act in 1975. Our exclusive fisheries management authority extended thereby out to the 200-mile limit of the "fisheries conservation zone," and--with respect to anadromous species --beyond. Salmon now carry our flag with them, if you will. That's our present position, as a matter of international law. (That position, of course, is congenial to our economic interests. By the same token, we excluded tuna from the scope of the Act because we want access to the tuna stocks off Chile, Ecuador and Peru.)

— A further example is the Ports and Waterways Safety Act. In 1972 we asserted the right--over the objection of the Coast Guard, as I recall--to establish construction, design, equipment and manning standards for vessels in our territorial sea. In spite of what I said when I was carrying the banner of the Environmental Protection Agency in international negotiations, there is a respectable legal argument to be made to the effect that the doctrine of "innocent passage" could be violated by some of the standards that the Coast Guard could presumably promulgate under the Act.

— In 1972, Section 311 of the Clean Water Act decreed that there would be no discharges of oil or hazardous substances, in "harmful quantities," into the contiguous zone. That was an interesting bit of "creep." The contiguous zone was a construct of the 1958 Convention, which recognized that a state could assert limited jurisdiction in an area not to extend further seaward than twelve miles; but its prerogatives in that area were limited to fiscal, sanitary, customs and immigration laws, and even those prerogatives were to be exercised only to the extent that activities in the contiguous zone might affect the territory or territorial sea of the coastal state. And so, we assumed, first, that pollution was a "sanitary" regulation within the intendment of the 1958 Convention; there is, moreover, no limiting language in this legislation that mirrors the provisons of the 1958 Convention relating to the continguous zone. This was a minor creep--just a little nudging of our jurisdictional limits.

— Then, of course, in 1977 we had major Clean Water Act amendments, including those of Section 311. Section 311 provided for civil and criminal penalties for the discharging of harmful quantities of oil and hazardous materials. In most of the provisions of this very tortuous piece of statutory material, however, there was a little clause which you could read to mean that we did *not* assert such jurisdiction with respect to foreign vessels on the high seas. But one provision, Section 311 (b) (2) (B), provided for civil penalties with respect to the discharge of hazardous substances which were determined by the Administrator of EPA to be "not removable." In that little section, there was no savings clause with respect to foreign vessels. Thus, we had apparent authority to assess a civil penalty of up to five million dollars against a foreign vessel not bound for our ports, one that was just passing through some area of the ocean where our fish happened to be located. The State Department was aghast. It had to face the fact that we appeared,

as a matter of jurisprudence, to be as irresponsible as Canada was when it passed its Arctic Waters Pollution Prevention Act. Subsequently, Section 311 was quietly amended, on the last day of the 95th Congress, to remove the offensive provision. It went out as quietly as it came in, but behind the scenes there was a good deal of jockeying for position. I think that some of the actors in this struggle were interested in vindicating personal positions, and I thought the 1977 provisions on non-removable hazardous substances were absolutely irresponsible. (I can say that now; I no longer work for the government). Those provisions didn't do a thing for the environment; and, after all, how many five million dollar civil penalties were we really going to assess under those provisions?

In sum, it is evident that our jurisdiction is as likely to creep as anybody else's, notwithstanding the legal positions we may take in international negotiations.

THE PURSUIT OF A TREATY

In the context of the Law of the Sea negotiations, I think there is less reason to worry about what we have been calling creeping jurisdiction than there will be in the absence of a Law of the Sea Convention. If those negotiations are successful, at least we will all know where we stand. Coastal states may end up with certain prerogatives with respect to foreign tankers in their economic zones, and they may lack certain other prerogatives, but at least everybody will know the rules of the game. I think the danger to navigational freedoms -- and to the industry representatives in this room -- will arise when we don't have a Law of the Sea Convention, when all we have is the nudging which I have described on the part of the United States, and which we would presumably see reflected in the actions of other countries in coming years.

At this point, I wish to stimulate debate. I have listened over the years to a lot of sloganizing about freedom of navigation on the one hand, and environmental pollution on the other. But, as it approaches the spectre of a world without a Law of the Sea Convention and with increasing demands for environmental controls, I think that industry should decide where and how its navigational interests can truly get hurt, and that it should concentrate on those areas, rather than sloganize on the basis of Hugo Grotius' 17th century doctrines. At the same time, when they formulate legislative and regulatory proposals with respect to the protection of the marine environment, I would ask environmentalists to consider broader interests of commercial and navigational freedoms, national security and the precedential effect on those interests of certain actions we in the United States might take. The non-removable hazardous substances legislation I discussed previously is illustrative. It certainly embarrassed our international negotiators, but, I suggest, it would not do very much for the environment.

IF NEGOTIATIONS FAIL

In the absence of a Law of the Sea Convention, I think it is appropriate to ask, "In what directions are coastal states likely to attempt to expand their prerogatives, and how will it hurt us, if at all?" What I am suggesting here is only the beginning of an analysis, but I have identified some areas in which we might expect jurisdiction to creep:

— First, ocean dumping--which I use in the legal sense of disposal of land-based pollutants at sea for the purpose of getting rid of them. Of course, jurisdiction over dumping will creep. The existing text of the Law of the Sea treaty (which could be cited as precedent by a coastal state) provides for a coastal state veto over dumping within its 200-mile economic zone. This is probably reasonable. It doesn't really threaten navigational freedoms; besides, if it's so important to dump this stuff in somebody else's zone, then one might question the environmental intelligence of proceeding with the activity in the first place. I don't think there's any serious question that, in the absence of a Law of the Sea settlement, a number of coastal states would assert such jurisdiction over foreign vessels in a 200-mile, or broader, zone. But dumping is an easy case.

— All the rest of my notes relate to Ships: What might coastal states actually do with respect to foreign vessels off their coasts? And what impact would they have on commercial and navigational interests? First, they could try to regulate discharges. (I am not referring to accidental discharges that result from accidents like the *Argo Merchant*; I mean operating discharges). What effect would that have? I suppose some coastal states might extend IMCO's "clean ballast rule" out to the 200-mile limit. The "clean ballast rule" provides, in essence, for no discharges of oil within 50 miles of the nearest land. But even if it were extended out to 200 miles, I question whether it would have a substantial effect on tanker operations.

— What else might coastal states do? They might attempt to assert jurisdiction to establish standards relating to construction, design, equipment and manning. On this front, navigational interests have been well served by the Law of the Sea negotiations to date. A provision of the current Law of the Sea text would prohibit a coastal state from establishing any such standards that diverged from international standards--that is, IMCO's standards --in their own territorial seas. But absent that sort of protection in a Law of the Sea treaty, I suppose that some coastal states could attempt to establish some sort of construction or design standards, like the ones we have been discussing in the context of California. Conceivably, that could hurt navigational freedom. Even so, I also think that a bit much is sometimes made of the argument that if the United States, and everybody else, could set standards in their ports or territorial seas, we would have a "crazy-quilt" of regulations. States have *always* had the authority to establish standards for vessels entering their ports, but we

don't have a crazy quilt of regulations. I am not suggesting that there could never be a divergent regulation, like the State of Washington's in the Arco litigation. But I don't think there would be a "crazy-quilt," nor do I think that states would really behave as sometimes feared. There is, in fact, a body of global expertise on this subject. People write books and have conferences about controlling pollution from tankers, and I doubt that there would be a lot of essentially irrational coastal state standards with respect to construction, design, equipment and manning. I could be wrong, of course, but my purpose is to stimulate debate.

— The next item is enforcement of international standards by which a foreign flag vessel is bound. I think there is a clear theoretical danger of such intervention by coastal states, absent a Law of the Sea settlement. I might add that, in my opinion, the Law of the Sea text as presently written means "business as usual," in spite of its lengthy discussions of enforcement of international standards by coastal and port states. The real meat of that text provides only for flag state enforcement of international standards, since it is difficult to imagine a situation in which a coastal state could invoke the powers purportedly given it by that text. So there is another way in which coastal states might seek to expand their jurisdiction. If they did, I think the protection for industry would be very practical: It is one thing to assert jurisdictional powers of one sort or another--"Don't throw cigarette butts in the river," and so on--but, after all, who is watching? Two hundred miles is a lot to police and patrol. You must catch the offender, stop him somehow, and subject him to your legal processes in one way or another. I have heard from our own Coast Guard how costly it would be, even for the United States, to behave in that way within our own 200-mile fisheries conservation zone. Consequently, I am not sure there would be, in fact, a great deal of interest in tracking down and prosecuting violators of, say, IMCO's 1969 amendments in 200-mile economic zones. Coastal states may prefer to let the next port-of-call worry about the problem; indeed, that may be the most economical response, even for environmentally concerned coastal states that are worried about tanker pollution.

— Still another way in which coastal state jurisdiction might "creep" is with respect to liability. The United States will probably pass the pending superfund legislation eventually; it failed on the last day of the last session of Congress. It would give persons damaged by polluting incidents a cause of action on account of events occurring on the high seas, with respect to resources located there. It would also require evidence of financial responsibility as a precondition to port entry. (The claim might ultimately be made--in fact, *we* might even make it --that no vessel can transmit some broad area off our coast unless it can produce evidence of financial responsibility). But even if there were stringent insurance requirements with respect to port entry in a significant number of ports, if the insurance companies were writing the required policies, then this form of jurisdiction

may not interfere with navigational freedoms, as a practical matter, either.

— The final area that occurs to me is traffic control. I left it until last, although it seems quite likely and, perhaps, quite sensible. After the *Amoco Cadiz*, the French showed up at the seventh session of the Law of the Sea Conference with new proposals on this score. But the utility of these proposals--the French answer to averting similar catastrophes in the future--would still depend on international assent to particular traffic control schemes. I don't know why it is necessary to be so chary about permitting coastal states to regulate vessels bound for their ports, or transiting areas off their coastlines. We should recognize the jurisprudential objection to that sort of "creep," but I think it is open to question whether anybody's ox would really be gored.

CONCLUSION

I suppose what I've said in the last five minutes suggests that I believe that many fears about encroachments on navigational freedoms are overstated. If that seems to belittle the commercial interests concerned, let me be even-handed in conclusion. I think that some of the initiatives I've hypothesized would, in fact, be silly, and I have a philosophical point to leave with the environmental community: I believe that a "zonal" approach to tanker pollution is philosophically offensive, and not merely with regard to navigational freedoms. As an environmentalist, I would not like a situation in which each coastal state retreated behind some imaginary boundary of 50 miles, or 200 miles, and say "You cannot discharge here, you must have insurance there," and so forth. Under such an approach, nobody would worry about the ecology of the oceans as a whole. With respect to the legitimate interests of coastal states in regulating tankers, would such rules, especially those relating to discharges, do any real good? If you enforce a rule against discharges within 200 miles of your coast, what do you do about the tar ball that starts at 201 miles? The only thing such a rule might change is the time that it takes a given clod of oil to get to the beach.

I hope that these remarks might stimulate some debate on an issue which has not been central to our deliberations over the course of the day, and I look forward to your comments.

SOURCES OF INITIATIVES DESIGNED TO PREVENT POLLUTION BY TANKERS

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This afternoon's discussion of *initiatives* to prevent pollution by tankers would be incomplete without direct consideration of the *initiators* of such regulation. In the time available a look at the sources of the myriad of such sometimes conflicting national and state laws must be foregone in favor of an attempt to identify the principal organizations--international, regional and nongovernmental --which have been responsible for the drafting and promotion of transnational multilateral agreements intended to prevent or minimize pollution of the sea by tankers. In other words, let the question be: "Who initiaties the initiatives?

INTERNATIONAL MARITIME CONSULTATIVE ORGANIZATION (IMCO)

The most important of these, of course, is the Intergovernmental Maritime Consultative Organization (IMCO). That organization was conceived of at the United Nations Maritime Conference which met in Geneva early in 1948 at the call of the United Nations Economic and Social Council (ECOSOC). IMCO came into formal existence with a permanent headquarter in London when the IMCO Convention was ratified or adhered to by 21 nations seven of which had at least one million tons of gross shipping. IMCO's link with the United Nations was established by the approval of

the General Assembly of the United Nations and by the Assembly of the International Civil Aviation Organization (ICAO) which also has maritime jurisdiction--and by the Assembly of IMCO itself.

One of the functions of IMCO, as set forth in its constitutive Convention, is "To provide for the drafting of conventions, agreements, or other suitable instruments, and to recommend these to Governments and to inter-governmental organizations, and to convene such conferences as may be necessary". Pursuant to this charge, IMCO has taken the initiative or taken some part in the formulation of the following international agreements most if not all of which have a direct or indirect relationship to the operation or movement of oil tankers:

International Convention for the Safety of Life at Sea, 1948; SOLAS); as amended in 1960;

International Convention for the Prevention of Pollution of the Sea by Oil, 1954, as amended in 1962 (OILPOL);

Convention on Facilitation of International Maritime Traffic, 1965;

International Convention on Tonnage Measurement of Ships, 1969;

International Convention relating to Intervention on the High Seas in cases of Oil Pollution Casualties, 1969;

International Convention on Civil Liability for the Oil Pollution Damage, 1969;

Special Trade Passenger Ships Agreement, 1971;

Convention on International Compensation Fund for Oil Pollution Damage, 1971;

International Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material, 1971;

Convention on International Regulations for Preventing Collisions at Sea, 1972, (COLREGS);

International Convention for the Prevention of Pollution from Ships, 1973, (MARPOL);

Athens Convention relating to the Carriage of Passengers and their Luggage by Sea, 1974;

Protocols to SOLAS and MARPOL, 1978.

OTHER INTERNATIONAL ORGANIZATIONS

IMCO has participated in other initiatives for the prevention of pollution by tankers with various international organizations. It works continously to co-ordinate measures to ensure safety at sea and in the air with ICAO, the International Telecommunications Union (ITU) and the World Meteorological Organization (WMO). In 1962 IMCO collaborated on the revision of the 1931 International Code of Signals with ICAO, the World Health Organization (WHO). After the stranding of the tanker *Torrey Canyon* in 1967, the United Nations Educational, Scientific and Cultural Organization (UNSESCO), the United Nations Food & Agriculture Organization (FCO), WMO and IMCO sponsored a Joint Group of Experts on the Scientific Aspects of Marine Pollution. IMCO and the ILO are also members of a committee on the training and mandatory certification of navigational officers. IMCO also renders technical assistance to developing countries under the United Nations Development Program (UNDP). The United Nations Commission on International Trade Law (UNCITRAL) was primarily responsible for the drafting of the 1978 United Nations Convention on the Carriage of Goods by Sea. Technical assistance was furnished by the International Monetary Fund (IMF) which suggested the unit of account for compensation for goods lost or damaged at sea be the Special Drawing Right (SDR) as defined by the IMF rather than 30 Poincare Francs.

IMCO also participated with the ITU in the preparation for the World Administrative Radio Conference held in Geneva in 1967, the United Nations Conference on the Human Environment held in Stockholm in 1971 and the current Third United Nations Law of the Sea Conference which has met in New York, Caracas and Geneva. The draft conventions which provided the basis for the work of the First and Second United Nations Law of the Sea Conferences were prepared by the International Law Commission. More codification of international law than progressive development of it, the four conventions produced by the first of those conferences contain only one reference (in Article 24 of the Convention on the High Sea) to the subject of this conference:

> Every state shall draw up regulations to prevent pollution of the seas by the discharge of oil from ships or pipelines or resulting from the exploitation and exploration of the seabed and its subsoil, taking account of existing treaty provisions on the subject.

Part XII of the Informal Composite Negotiating text produced by the Third Law of the Sea Conference is entitled "Protection and Preservation of the Marine Environment." Articles 209 through 212 and Articles 215 through 222 are devoted to the provision for and enforcement of international rules and national legislation to prevent, reduce and control pollution of the marine environment from vessels.

REGIONAL ORGANIZATIONS

The following examples suggest the nature of regional initiatives being taken to prevent the pollution of the sea by tankers and other causes.

After the April 1977 Ekofisk oilfield blow-out at the Bravo platform on the Norwegian continental shelf, representatives of all the North Sea and North Atlantic States met in Oslo with representatives of the European Economic Community (EEC) and the Organization of Economic Co-operation and Development (OECD). They considered the development of further mutual assistance in emergencies under the 1969 Bonn Agreement for Co-operation in Dealing with the Pollution of the North Sea by Oil.

After the March 1978 grounding of the tanker *Amoco Cadiz* on the Brittany coast, the Council of Europe held public hearings to obtain more detailed information to help prevent accidents of this kind and to minimize their damage. Delegates from 16 member states of the Council of Europe were joined by representaives of such international and regional organizations as IMCO, UNESCO and the EEC. Participants urged that more European countries ratify SOLAS and MARPOL and the 1978 protocols to those two conventions.

After the January 1975 grounding of the tanker *Showa Maru*, near Buffalo Rock in the Singapore Straits, the foreign ministers of the three Malacca Straits littoral states (Malaysia, Singapore and Indonesia) met at Manila in 1977 where they adopted final texts on safety of navigation in the Straits and guidelines for future action including three traffic separation schemes. If these proposals are endorsed by the IMCO Maritime Safety Committee, they will have the force of law under the stipulations of COLREGS 1972 taking place alongside the IMCO-adopted separations schemes which went into effect on the Dover Straits in July 1977.

NON-GOVERNMENTAL ORGANIZATIONS

As early as 1882 the International Law Association adopted the Liverpool Conference Form Bill of Lading, the terms of which were substantially promulgated the following year by the New York Produce Exchange. Another private law organization, the Comite Maritime International (CMI), which was originally organized as a committee of the International Law Association, became an independent entity composed of many national associations devoted to the development of uniformity in international maritime law. The Hague Rules of 1921 as amended at Visby, Sweden, in 1963 (effective 1977) and revised as the Hamburg Rules in 1978, are examples of the work of CMI.

The Malacca Strait Council (MSC), which was formed by a number of interested Japanese trade organizations to work for greater safety in that Strait, did much of the spadework for the 1977 meeting of the Malacca Strait littoral states meeting referred to before.

A resolution urging all states to become parties to the Convention for the Prevention of the Pollution of the Sea by Oil and the tightening of these and other such international standards was passed

in October, 1978 by the General Assembly of the International Union for the Conservation of Nature and Natural Resources (ICUN) at a meeting of the Assembly in Ashkhabad, USSR. The ICUN helped in the preparatory work that led to the establishment of the United Nations Environmental Program. Organizational members of the ICUN represented at this Conference are the Audubon Society and the Sierra Club.

Such transnation corporations as British Petroleum, Esso, Gulf, Mobile, Shell, Standard Oil and Texaco have sponsored the drafting and adoption of the 1969 Tanker Owners Voluntary Agreement Concerning Liability for Oil Pollution ("TOVALOP") and the 1971 Contract regarding an Interim Supplement to Tanker Liability for Oil Pollution ("CRISTAL").

CHOICE OF FORUM

Although IMCO seems to be well entrenched as the organization most involved in the development of international maritime law, there are those who prefer that task be performed elsewhere. From the "developing" world (the Group of 77) come suggestions that the initiatives for the development of international economic or commercial law eminate from organizations such as UNCTAD and UNCITRAL or the United Nations Committee on Transnational Corporations where decisions are arrived at on a basis of "one nation, one vote". Others believe that all of the organizations just referred to are too political and that the work of these organizations should be limited to the furnishing of technical support for the International Law Commission to which the task of the "codification and progressive development of international law" is assigned by the Charter of the United Nations.

COMMENTS

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Mark Zacher: I want to make several points pertinent to both the process of developing international law on oil pollution and the future control of oil pollution.

Turning first to the process, it is important to recognize that the U.S. has had and still does have a tremendous amount of influence in the IMCO law-making process. This flows largely from the need of many foreign flag vessels to service the American market but it also derives from the U.S.'s general world role and the technological expertise and resources of its government. Behind American policy--particularly since the early 1970s--there has been the growing influence of environmentalists and their allies on Capitol Hill. This is not to say that the views of government officials did not change to a certain extent independently of domestic political pressures but the latter certainly led them to adopt stronger environmentalist stances.

Concerning the future control of oil pollution, the most urgent items are the entry-into-force of the 1973 MARPOL Convention and the 1978 Protocols and the enforcement of international regulations. The existing conventions may not constitute the ideal set of regulations but few would question that their implementation could have a major salutary impact on the marine environment. To focus everyone's attention on possible new unilateral or international options can only undermine efforts to achieve the entry-into-force and en-

forcement of accepted IMCO conventions. There are times for innovation and there are times for making existing systems work and we are in the latter category after the major changes of the 1972-78 period.

I don't think that anyone who is really familiar with the issues of furthering environmental protection and promoting maritime safety would not identify enforcement of regulations as a crucial issue. Major resources must be devoted to analyzing this complex problem and undertaking various enforcement strategies. Much can be done to improve inspection procedures by classification societies and governments to assure that vessels are complying with construction and equipment regulations. Also, both governments and industries can improve compliance with discharge regulations by frequent and thorough inspections of vessels in ports--and at least some surveillance of coastal waters. The past inadequacy of inspections of tankers in loading ports to check on compliance with the LOT system is well known. With the advent of crude-oil-washing as the primary oil pollution-control system the locus of inspection will shift largely from loading to discharge terminals. This will enhance the ability of the developed oil-importing nations to promote compliance but the opportunity must be exploited. Connected with the inspection issue is the need to perfect oil-monitoring systems (hopefully of a "black-box" type in the long run) which will allow port inspectors to gather information on a vessels's discharges at sea while it is in port. It is difficult for me to understand why more progress has not been made in this area during the last six years.

Another crucial segment of an enforcement system is the application of positive and negative sanctions--that is, the use of rewards and punishments. The main possiblity for the use of rewards is compensation by the oil companies to tanker owners for costs incurred in complying with regulations. This is a major problem which has not been solved by the ICS "voluntary code" or the entry-into-force of the 1969 Amendments. Turning to the application of penalties, it is important to realize that here also industry can play a key role. The oil companies can, for example, charge for a failure to deliver residues. Governments can, on the other hand, detain vessels in port to have deficiencies corrected and apply meaningful financial penalties to vessels committing infractions.

In this discussion of enforcement I have only been able to light briefly on some of the problems. However, they all merit considerable attention and effort. In the past, oil pollution conventions have generally been "paper law", and the emergence of "real law" in the future requires continuous and intensive devotion to assure vessels' compliance with the conventions.

PANEL PRESENTATIONS AND DISCUSSION

Sid Wallace: Thanks very much. I'd like to start with Harvey Silverstein.

Silverstein: I'm Harvey Silverstein from the University of South Carolina, Department of Government and International Studies. My area of specialization is Science Technology and International Affairs, with a special focus on ocean problems and policies. I spent some time at IMCO which eventually resulted in a study which I've told some of you about. I'd like to share with you a couple of the results and then sketch out for you an idea which I'm sure will move us off in another direction or a new direction as far as regulation of the oceans. While I was at IMCO, one of the things that I did was look at who participated in IMCO. I did this to the point where I had the name, the position, and the country of every single person who participated in every session of IMCO from 1958 through 1972. What I did then was computerize this list so I could analyze it statistically and compare countries, types of representation, and so on. One of the things that I learned from that analysis was that a nation's acceptance and ratification of conventions correlated very definitely to that nation's participation in the deliberations. By participation, I mean not just in any IMCO assembly, but in the Maritime Safety Committee, the Legal Committee subcommittees, the working groups, and so on. This definite rela-

tionship indicates that if we want to see wider international acceptance in implementation of IMCO's conventions, recommendations, and so on, we have to insure that other countries, particularly developing countries, have technical representatives in the final working groups, in subcommittees, because that's where many of the real decisions are made. Second point: in the years from 1958 to 1972, I also found that there was zero representation on any environmental groups. That's over 3,000 individual participations. There were zero from any recognized environmental interests other than, and I was corrected on this by Admiral Benkert's aides about three years ago, the U. S. Coast Guard. So, that's a qualification. I don't want to take the time to tell you any more about that study, but I'd like to just set forth another possibility which is on the horizon--a technological possibility which is bringing about a time when we can have a global monitoring and enforcement system for pollution. This is now technologically feasible using three technologies. This will also do three things. It will make the lawyers eager; it will generate some kind of definite responses from the industrial representatives and will, finally, create a possibility for a global monitoring system. The first element in such a system is what we're doing now with SEASAT. SEASAT can enable us to pick up and locate an oil spill anywhere in the world very soon after it happens. It can pick up using different sensors and spot the sheen on the water. It depends on how many SEASATS there are. We can bring it to a matter of hours of location. The second involves a top secret, undersea listening network that the United States has already deployed to follow Soviet submarines. What it does is listen in on the sound from the submarine.

Unidentified Voice: Are you discussing classified information?

Silverstein: No, everything I'm telling you is available in open sources. Basically, what it can do is fingerprint the sound of any ship to the extent that an operator sitting in San Diego can identify the specific ship 5,000 miles away. We have the computers that can do it, and we can use it for merchant ships. Now it's being used basically to follow submarines. The third element is something that the Coast Guard is already using with suspect tankers and that is the gas chromatographic analysis of the oil which determines beyond the shadow of a doubt which tanker released the oil. I will leave to you the political difficulties of trying to bring about such a system.

Ann Baker: I'm Ann Baker, the Energy Impact Coordinator of the South Carolina Coastal Council. We are the customs international agency in South Carolina. I'm going to bring you to the very practical level now. The Coastal Council was founded about a year and a half ago. It's quite different from previous state agencies in South Carolina in many ways. We have permitting authority and the authority to develop a management program. One of the things that encouraged the passage of our legislation was that we were going to streamline the permitting system within South Carolina. Two weeks after our bill passed, giving us the permitting authority, the

legislators apparently did not carefully examine the substance of additional legislation, and gave the same authority to two other agencies in the state as it applied to oil and gas facilities. So, there is a clear problem there in terms of duplication of authority which will be worked out through coordination, but it does sort of undermine the streamlining effect. In our legislation, we were told to monitor for oil spills and to help with the clean-up, but given no authority whatsoever. Essentially, the authority for clean-up is under the Department of Health and Environmental Control (DHEC) and the Water Resources Commission. Any terminal or transportation permits come from DHEC and we will coordinate with them. I had this strong feeling as I listened to Trevor O'Neill talk that on the state level we are absolutely at the other end of the spectrum in terms of sophistication with tanker traffic and oil and gas development. In our defense, I have to say that the need is also at the other end of the spectrum. A year ago, when the March 1977 sale for the first South Atlantic lease was pending, there was a great deal of talk and interest. The Water Resources Commission was actively trying to get their rules and regulations onboard before that lease sale took place, which they were not able to do. Once the lease sale took place, of course, there were no tracts leased offshore of South Carolina. That kind of interest has again sort of gone slightly undercurrent. Our particular agency has been in a rush situation getting our coastal management program underway, and I see us dealing with tanker traffic and that kind of thing during implementation and really not very much at all up to this point.

Sid Wallace: Thanks. That's a very useful comment on Mr. O'Neill's assigned subject. It does give us another point in the spectrum as states press problems.

Robert S. Horowitz: The Federal - State interface was a very difficult factor on which to advise my client, the Federal reglator. Application of the recent *Ray v. Arco* and *Chevron v. Hammond* decsions to continuing Federal-State conflicts is complicated in the practical world. Several states still propose and enact regulations which conflict with Federal requirements for design, construction, equipment and operation of tankers. The Department of Transportation has the responsibility to facilitate transportation and the Coast Guard to ensure safety and preserve the marine environment. The Coast Guard must also negotiate within IMCO. Do these responsibilities suggest that the Federal Government should initiate litigation to challenge the conflicting state requirements, or should this be the function of the private sector adversely affected by the State regulation? This is a question for which there is, perhaps, no general answer, but it is a continuing and perplexing issue.

As to the institution of IMCO, I note the ability of IMCO and its member nations to adopt new concepts of international law to respond better to member states' needs. It has been noted by several participants that IMCO conventions take several years to

enter into force. It has also been pointed out that this was the fault of the member nations rather than of IMCO itself. Because of this, it was important to the United States to adopt a mechanism whereby the internation l requirements could be implemented by a date certain regardless of entry into force of the treaty, and whereby the international requirements could be applied uniformly to all vessels that call at United States ports. IMCO and its member nations responded at the TSPP Conference by adopting resolutions which encourage nations to implement the requirements by a date certain, regardless of entry into force of the protocols. In addition, the Conference extended a principle developed at the 1973 Marine Pollution Conference--the "no more favorable treatment" clause. This clause essentially provides that no more favorable treatment shall be provided ships of non-parties while in ports of parties. The provision enables the United States to apply the TSPP requirements, and the 1974 SOLAS and 1973 MARPOL requirements,to all ships that enter United States ports. I believe that these provisions are new developments in international law and illustrate the ability of the institution, IMCO, to respond to the needs of its member nations.

OVERVIEW OF TRANSPORTATION OF OIL AND NATURAL GAS BY TANKERS IN ALASKAN WATERS

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ABSTRACT: There are two components of the oil transportation system associated with the marine leg of the Trans-Alaska Pipeline. The first is the Coast Guard Vessel Traffic Service which includes vessel traffic lanes throughout Prince William Sound into Port Valdez, sophisticated radar surveillance of the critical part of the transit through Valdez Arm and Valdez Narrows, and complete VHF-FM communications coverage throughout the area. All of this is monitored from the Vessel Traffic Center in Port Valdez. All tank vessels are reguired to participate in the system and adhere to the traffic separation scheme. Each tank vessel operating in Valdez is also required to carry, in addition to equipment required for all tank vessels, two marine radars, a LORAN-C receiver, and a rate-of-turn indicator, and is required to carry a pilot throughout its transit of the area and use tug assistance when required by the VTC.

The second component is the Alyeska Marine Terminal located in Port Valdez. It is one of

the most sophisticated port facilities in the world and is the only U. S. port capable of handling super tankers. The port has the capacity to transfer over 2 million barrels of oil per day and can handle 4 ships ranging from 80,000 to 250,000 dwt at any one time. The Terminal provides complete oil spill clean-up equipment to handle an oil spill anywhere in the VTS.

The operation at Port Valdez is a model operation, not only from the perspective of equipment and technology, but also from the aspect of cooperation between the Federal and State governments and private industry. This presentation will briefly outline the Coast Guard's Vessel Traffic Service (VTS) in Prince William Sound and the Alyeska Marine Terminal in Valdez, Alaska. The authority for the Coast Guard to establish and operate Vessel Traffic Services is set forth in the Ports and Waterways Safety Act (PWSA) of 1972 as amended by Port and Tanker Safety Act of 1978. The Trans-Alaska Pipeline Authorization Act, passed in November 1972, amended the PWSA to specifically require the Coast Guard to establish and operate a Vessel Traffic Service in Prince William Sound (PWS). The Vessel Traffic Service (VTS) commenced operation on July 25, 1977.
Safety Act PWSA) of 1972 as amended by Port and Tanker Safety Act of The Trans-Alaska Pipeline Authorization Act, passed in November 1972, amended the PWSA to specifically require the Coast Guard to establish and operate a Vessel Traffic Service in Prince William Sound (PWS). The Vessel Traffic Service (VTS) commenced operation on July 25, 1977.

The primary responsiblity of the VTS is to manage traffic enroute to and from the Alyeska Marine Terminal, which is located across Port Valdez from the city of Valdez. The primary elements of the VTS are as follows: (1) traffic separation; (2) communications; (3) shoreside surveillance; and (4) regulations.

TRAFFIC SEPARATION

The VTS Traffic Separation Scheme (TSS) is the marine equivalent of a divided highway (Figure 1). It officially commences at Hinchinbrook Entrance, Prince William Sound's major opening to the Gulf of Alaska. The TSS is laid out in a north-northwesterly direction through Cape Hinchinbrook, then in a northerly direction through the central Sound to Bligh Reef. Over this stretch of

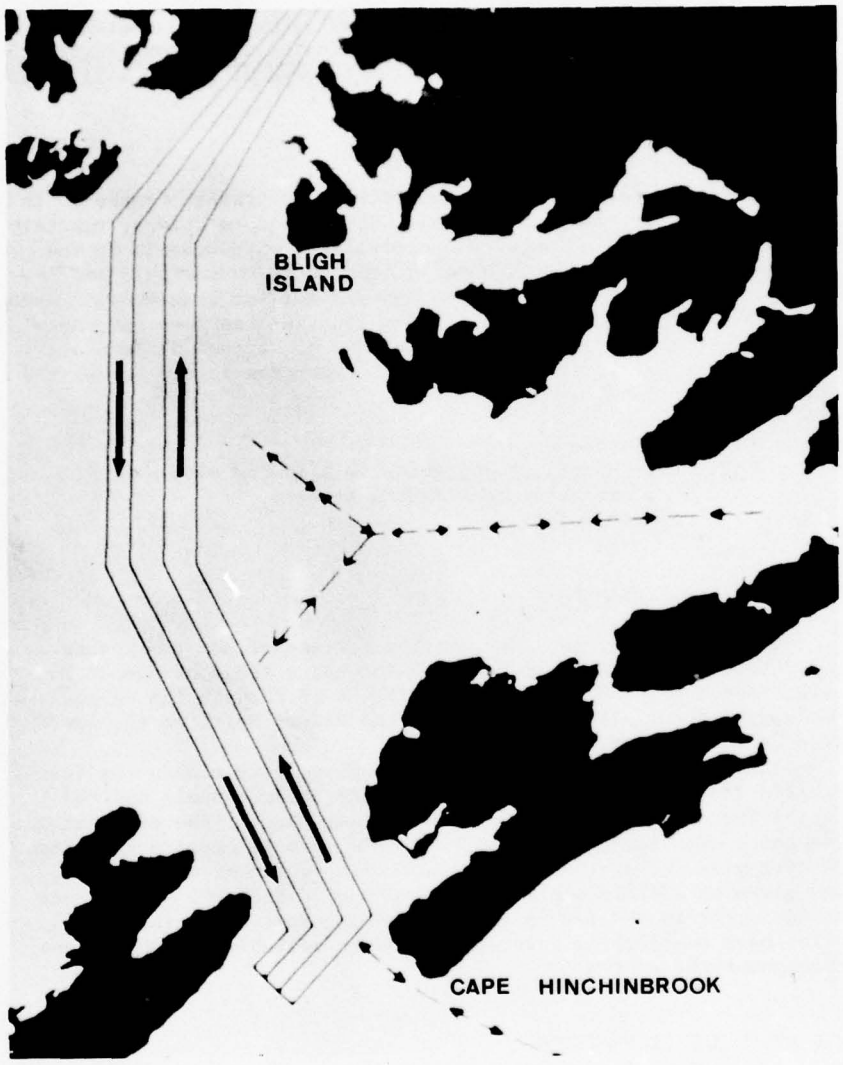

FIGURE 1. THE VTS TRAFFIC SEPARATION SCHEME (TSS).

water, the traffic lanes are 3/4 of a mile wide and the separation zone between them is a mile wide. Inbound traffic proceeds in the east lane, outbound traffic in the west lane. Beginning at Bligh Reef, the TSS narrows as it enters Valdez Arm. At its termination point, just south of Jack Bay, the lanes are 800 yards wide and the separation zone is 700 yards wide. A stretch of water approximately 9 miles long through Valdez Narrows, from Middle Rock to Rocky Point, has been restricted to one way traffic for the tank

vessels over 20,000 dwt (deadweight tons). The VTS is controlled from the Vessel Traffic Center, (VTC), located in Valdez (Figure 2), using VHF-FM and microwave facilities throughout Prince William Sound.

COMMUNICATIONS

Communications is an essential element in traffic control. In addition to radio equipment we have VHF-FM radio stations, remotely controlled, through which we can communicate with vessels in the VTS area. We maintain continuous guards on FM Channels 13 and 16. Channel 13 has been designated as the VTS working frequency. Channel 16 is the distress and calling frequency. We also have the capability of communicating on FM Channels 6, 21, 22 and 81 from all sites. There are three VHF-FM sites in addition to the one at the traffic center:

(1) Johnstone Point;
(2) Cape Hinchinbrook, which is also the site of an automated lighthouse; and
(3) Potato Point.

SHORESIDE SURVEILLANCE

Potato Point is also the location for one of our two remote radar sites. The radar at Potato Point has a range of almost 25 miles, and can track vessels from Bligh Reef through the Narrows. The second radar site is located at the Valdez Spit, on the north side of Port Valdez.

Both radar sites are monitored 24 hours a day within the Vessel Traffic Center by VTC watchstanders. The radar console has the capability of being changed from one radar site to the other at the touch of a button. The supervisor's console permits the watch to determine the status of all electronic equipment at any time, and gives an audible alarm in the event of a failure. Each piece of equipment in the system has a back-up. Most communications sites have overlapping coverage to insure reliable communications throughout the system.

VTS RULES AND REGULATIONS

The Rules and Regulations for the Vessel Traffic Service are contained in the VTS Operating Manual. All vessels using the system are required to have a copy on board. The Manual also contains detailed explanations of the regulations, the one-way traffic system, tug requirements, details of fishing activity, weather reporting information, sample chartlets, sample messages and other applicable rules and regulations.

All vessels over 300 gross tons, all vessels carrying 6 or more passengers for hire, and all tugs with tows in excess of 250

FIGURE 2. DIAGRAM OF PORT VALDEZ.

feet *MUST* participate in the system. The regulations require all Tank Vessels over 20,000 DWT to have two Marine Radars, a LORAN-C Receiver, and a Rate-of-Turn Indicator, and to use Tug assistance when required by the VTC.

To provide precision navigation capabilities off-shore as part of a nationwide program, three additional LORAN-C stations were installed in the Gulf of Alaska at a cost of 13 million dollars. The following sites provide coverage to Prince William Sound: Shoal Cove in sourtheast Alaska near Ketchikan; Tok, on the ALCAN (Alaska Highway); and Narrow Cape, on the tip of Kodiak Island.

A number of factors had to be taken into consideration during the development of the operating procedures and regulations for the Vessel Traffic System. They are specifically tailored to ensure an appropriate level of safety. The degree of regulation can be broken down into three general areas. The approaches to Prince William Sound are characterized by deep water, relatively little vessel traffic, a wide entrance to Prince William Sound, and excellent radar and LORAN-C navigation capabilities. To enhance our capability to control and manage traffic, we have implemented traffic lanes and have improved and modernized the aids to navigation in the area. All vessels are required to have a qualified pilot on board from Cape Hinchinbrook to Port Valdez. Vessels are required to provide position reports off-shore and at Hinchinbrook--and as they proceed through the system.

As vessels enter PWS, the circumstances with regard to navigation remain basically the same. There is an increased proba-

bility of traffic; however, the water is still deep, navigation is enhanced by good radar targets from the rock cliffs and islands in the vicinity, and the LORAN-C coverage is exceptionally accurate. As vessels move up Valdez Arm into Port Valdez, the possibility for congestion increases. For this reason, we impose a number of additional requirements in this area. A one-way traffic lane, or traffic zone, has been established between the pilot station at Rocky Point and Entrance Island, at the north end of Valdez Narrows.

We provide radar surveillance of the entire area from the Potato Point and Valdez Spit sites. We require that vessels within the system use tug assistance getting underway from the dock and that they have a tug available to assist them in the vicinity of the Narrows, if necessary. We also have the authority to close the system in the event of adverse weather, traffic congestion or some other emergency. A speed limit has been imposed on vessels transiting the Narrows. The speed limit for laden tank vessels outbound is a maximum of 6 knots between Middle Rock and Potato Point, with a maximum speed limit of 12 knots elsewhere within the one-way zone. The maximum speed limit for unladen vessels is 12 knots throughout the entire one-way zone.

VALDEZ NARROWS

During the preliminary planning stages of the VTS, one point within the system was singled out as an area of particular interest, and that is the Valdez Narrows and an outcropping within the Narrows referred to as Middle Rock. (Figure 3). The useable portion of the channel is located to the East of Middle Rock, and is 900 yards wide. This is compared to some European ports handling super tankers which have channels as narrow as 400 yards.

ALYESKA MARINE TERMINAL

The Alyeska Marine Terminal is located on the south side of Port Valdez (Figure 4). One of the unique features of this particular terminal is the ballast water treatment facility, which is located in the center foreground. The terminal is able to take dirty ballast water from the tank vessels, put it through a series of holding tanks, and take the oil from the water, returning the water into Port Valdez in a manner which is acceptable, and where it does not adversely affect the marine environment. The Alyeska Terminal is comprised of four berths at present. Another unique feature of the terminal is the floating berth. Berth One was built in one piece in Japan and brought to Valdez on a barge. The barge was sunk and the berth floated off. It is attached to a rock cliff adjacent to Port Valdez. This particular berth rests in 120 feet of water and can accommodate vessels up to 165,000 dwt. All of the berths are equipped with heavy fenders to insure that the vessels do not ride against the pier and do any damage to it. They are also all equipped with remote control windlasses, which permit one berth

FIGURE 3. VALDEZ NARROWS AND MIDDLE ROCK.

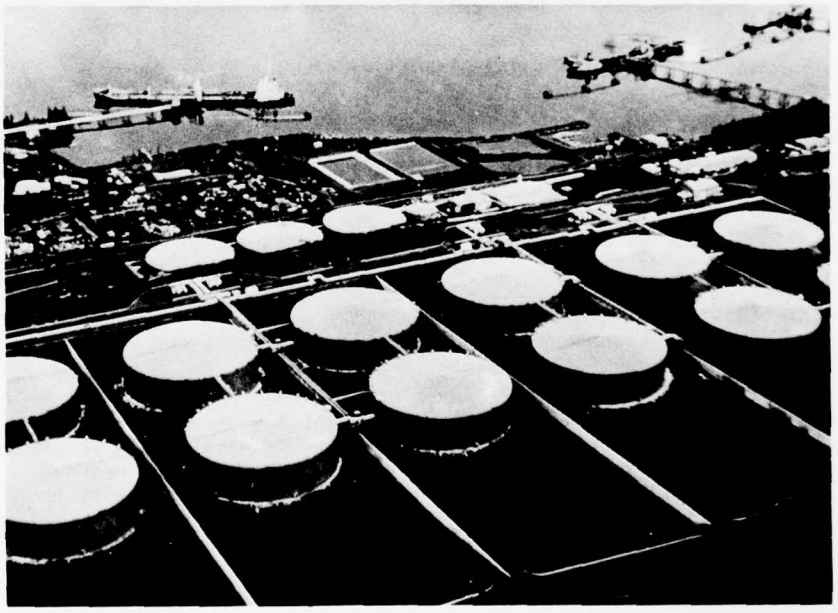

FIGURE 4. ALYESKA MARINE TERMINAL.

operator to unmoor a vessel by remotely tripping the hooks that hold the mooring lines.

The entire operation of the terminal is controlled from the Operations Control Center. The pipeline is controlled from the same control center, as well as the terminal itself.

THE LOADING OPERATION

The loading operation commences at the tank farm. The oil comes down one of two transfer lines to the berth itself, where it passes through a pressure control relief valve which is designed so that it can be set to deliver oil at a specific pressure. The ship advises the terminal of the pressure at which it wishes to receive the oil, and if that pressure is exceeded, this valve will automatically shut the loading operation down in a period of seven seconds. The operation is continually monitored by radio transmission. The oil passes through one of four articulated loading arms which are remotely controlled. Connection between the loading arms and the vessel is accomplished by use of a hydraulically controlled mechanism. This mechanism can be quickly released, should it become necessary to disconnect from the vessel in an emergency. The release can be accomplished in approximately twenty seconds. The terminal can load at a rate of up to 110,000 barrels per hour depending on the capability of the vessel.

EMERGENCY EQUIPMENT AND PROCEDURES

All berths are equipped with fire-fighting foam-generating equipment and fire-fighting monitors. The tug boats that are available at the terminal can be used to fight fires at the terminal, in addition to pollution, as all of the tugs are equipped with fire-fighting monitors. The Alyeska Marine Terminal has provided complete oil spill response equipment as part of its inventory in the event of an oil spill from the dock or anywhere within the VTS. Tugs are available for use at the terminal and for oil pollution response requirements 24 hours a day, 7 days a week. Alyeska has a small boat harbor where it keeps all of its oil pollution response equipment. This facility if located at the terminal.

In closing, it should be noted that Alyeska is the model of a oil port facility, It is equipped with the most sophisticated equipment and is manned by highly trained personnel. It is not only the largest oil transfer point in the United States and the only U.S. port capable of handling supertankers, but is also one of the safest ports in the world. It is also a model for cooperation between the Federal and State governments and private industry necessary to insure a safe, effective port operation.

TOPIC D

IMPACT OF NEW LAWS AND REGULATIONS ON THE TANKER INDUSTRY

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University of South Carolina Law School
Columbia, South Carolina

Good Morning. As this is the last day of the Conference, let us immediately begin with our distinguished speakers. Our first speaker this morning is Mr. George Steele, the President of Interocean Management Corporation. He is also a retired vice-admiral.

POLLUTION PREVENTION RULES AND TANKERS,

PUTTING REQUIREMENTS INTO PRACTICE

George P. Steele
Interocean Management Corp.
Philadelphia, Pennsylvania

ABSTRACT: The Tanker Safety and Pollution Prevention Conference held in London in February of 1978 under the auspices of the Intergovernmental Maritime Consultative Organization (IMCO) resulted in a comprehensive new group of rules for tankers.

This paper describes the new standards for construction and operation of tankers, discusses how owners can comply, and gives general ideas of the costs of new features.

The decisions that owners must make are outlined, as are the number of variables that will influence the outcomes of those decisions. The only certain conclusions that can be reached are that some ships will be retired from service and that higher transportation rates will result from the new rules.

The crucial importance of personnel performance in further efforts to reduce pollution is outlined, with thoughts on the need to weigh the potential benefit of further equipment rules against their cost.

After years of controversy and recognition of the need to improve international control over substandard tankers and irresponsible tankship operators in order to protect the marine environment, and international conference was held in London last February. The conference was held under the auspices of IMCO, the Intergovernmental Maritime Consultative Organization, a United Nations body that has proven over the years to be one of the most productive and professional of all the U. N. bodies. Considerable credit for timing and the urgent pace of the meeting must be given to President Carter, whose Presidential Initiatives of 1977 gave notice of the concern of the United States and its determination to move forward actively with efforts to eliminate pollution from ships.

The U. S. delegation was headed by Alan Butchman, Deputy Secretary of Transportation and Rear Admiral W. M. Benkert, then head of the Coast Guard's Office of Merchant Marine Safety, and included representatives of industry, labor, government and environmental groups. The results of the conference are embodied in two protocols that will amend the 1974 International Convention for the Safety of Life at Sea (SOLAS) and the 1973 International Convention for the Prevention of Pollution from ships (MARPOL).

The new requirements will only become binding six months after they have been ratified by fifteen countries whose fleets constitute 50% of the world's fleet. In the meantime, in the interest of bringing the advantages of the rules into being as early as possible, the conference adopted a resolution encouraging individual member nations to enact the provisions into law in their respective countries without waiting for the protocols to be ratified.

In the United States, Congress has recently passed the Port Safety and Tank Vessel Safety Act of 1978, which embodies the majority of the IMCO regulations as well as other provisions.

As the impact on tanker owners worldwide of the new IMCO rules is considered, there is one aspect that must be emphasized. The costs associated with these "hardware" solutions are not small. Yet it is fair to expect that the requirements will provide benefits that bear a supportable relation to their cost.

The work of the February 1978 IMCO Conference will certainly result in less pollution of the oceans. But there remains an opportunity for future progress in reducing accidents caused by personnel error. U. S. Coast Guard statistics indicate that human fallability plays a role in 85% of all marine accidents. No protective design or preventive hardware will be successful if careless shiphandling, inattention, lack of training, drug abuse, failure to use provided equipment, or sloppy navigation cause a collision or drive a ship aground.

Industry has recognized the human part of the problem and responded with shiphandling trainers and video-taped crew training programs. The IMCO Convention on Standards of Training and Watchkeeping which was held in London this past June, and which is being discussed separately at this seminar, made landmark progress in establishing standards for crew qualifications and shows that governments share industry's conviction that the human element is

really the key to improved safety. It is imperative that the proponents of hardware solutions to pollution problems recognize that time and money should be spent where they will be most effective, and that there is a need for measures that will repay the investment in a worthwhile fashion.

Vessel owners have had some time to reflect on what must be done to bring their ships into compliance with the comprehensive agreements that were signed in February, and the process of national enactment of its measures has begun.

The conclusions of the conference have been applauded and endorsed by the industry as a positive step forward with the expectation they will help to reduce the overall amount of oil discharged in normal operations. There is also agreement that the new measures will enhance safety, which may in turn reduce accidents and accidental pollution.

There is a considerable amount of highly technical work that must be done to enable ships to comply. In some cases the new requirements are at the boundaries of the current "state of the art". There is general belief that the technical problems can be overcome. Common sense will be needed though, to translate the latest technical advances into safe and reliable systems that achieve their intended purposes, not just once, but every day for years. New equipment must work properly and be well maintained. Most important of all, the personnel who crew the ships have to be trained to operate and maintain the new systems. They must understand the machines and the procedures. That training will take time, effort, and money.

There must be recognition that the costs and problems, and even the successes of the new regulations cannot be foreseen completely now. In the aggregate, the results and the effects of the new rules will be determined by literally hundreds of individual decisions by owners of individual ships; although the choices seem clear and the numbers are known in some areas, the outcome of all those decisions cannot be predicted with certainty.

Let us look at the new IMCO protocols, examine how an owner can comply with each provision, and consider what compliance will mean. In each case brief abstracts of the new regulations are given. The complete texts are considerably longer and in some cases are supplemented by specifications.

TWO RADARS

> "All ships of 1,600 tons gross tonnage and upwards but less than 10,000 tons gross tonnage shall be fitted with at least one radar. All ships of 10,000 tons gross tonnage and upwards shall be fitted with at least two radars, each capable of operating independently of the other."

This requirement is already met by ships of responsible owners all over the world. The U.S. Coast Guard's inspection of vessels

entering U.S. ports have found that virtually every U.S. flag tanker and ninety-five percent of the foreign flag tankers inspected have two radars. For those owners who need to install a second unit, a comparatively small investment will be required, and the installation itself can be accomplished with a minimum of time out of service for installation of external cables and the antenna. A new radar, installed, costs in the vicinity of forty thousand dollars. Installation times vary from about two to about seven days, with perhaps only one or two days of out of service time for the vessel.

COLLISION AVOIDANCE AIDS

"Invites the Inter-Governmental Maritime Consultative Organization:

(a) to develop performance and standards for collision avoidance aids as a matter of urgency and not later than 1 July 1979;
(b) to prepare, within the same period, requirements for the carriage of such aids on all ships of 10,000 tons gross tonnage and upwards so that Chapter V of the International Convention for the Safety of Life at Sea, 1974 can be amended at the earliest practicable time."

Collision avoidance aids are electronic devices designed to analyze the movement of radar targets and give warning of any targets that will pass closer than a safe distance from the equipped ship. They usually provide a visual display of the expected paths of the targets on the radar scope and may include an ability to analyze the effect of a proposed maneuver on the traffic situation.

The reason for a study of these devices is that there has *not* been agreement yet on the proper level of sophistication for this equipment. There are several types already available and already in service on ships, but some do more than others, and some have worked better or are more reliable than others. The goal of the study is to produce a set of agreed standards by July 1, 1979. Once the results are in, the task will be for equipment makers to be sure that their products meet the specifications, and if necessary, to change their models or develop new ones that do the job. The ship owners will then have to install them and train their crews in proper use of the equipment. The training is vital, since all ships' deck officers will need to have confidence in the equipment without developing blind reliance on it as a substitute for alertness and a proper watch.

Our own experience may be illustrative here. We have several different types of collision avoidance aids in our fleet, and some have not been always acceptably reliable. Our officers have the knowledge to use the aids properly, but they must be satisfied that the systems are reliable, and so must we in shoreside offices.

What will it all cost? That depends on the new standards and on degree of fit with installed radars, but a representative cost is about $80,000 to fit the system to an existing radar.

STEERING SYSTEMS

> "The following shall apply to every new tanker of 10,000 tons gross tonnage and upwards under the provisions of Regulation 1(b) (iii) of the present Protocol, and to every existing tanker of 10,000 tons gross tonnage and upwards not later than two years from the date of entry into force of the present Protocol.
>
> (1) two remote steering gear control systems shall be provided, each of which shall be operable separately from the navigating bridge..."

The new steering system requirements do not require any technical advances or new techniques. The IMCO standards for existing ships are already met by many of the current fleet. Those few ships that do not already meet the steering specifications for existing ships will have to undergo an expensive retrofit, and, because they are older, will have to recover the costs over a shorter remaining ship life if they can. There is a high probability that such vessels cannot meet other new rules, and must be retired.

The standards for new vessels are consistent with the capabilities of most new designs, so there does not appear to be any substantial additional cost to meeting the new vessel rules, and the cost can be recovered over the entire life of a new vessel.

INERT GAS SYSTEMS

> "(a) For new tankers of 20,000 metric tons deadweight and upwards, the protection of the cargo tanks deck area and cargo tanks shall be achieved by a fixed deck froth system and a fixed inert gas system...
> (b) Any existing tanker of 20,000 metric tons deadweight and upwards engaged in the trade of carrying crude oil shall be fitted with an inert gas system...not later than a date:
>
> (i) for a tanker of 70,000 metric tons deadweight and upwards, two years after the date of entry into force of the present Protocol; and

(ii) for a tanker of less than 70,000 metric tons deadweight, four years after the date of entry into force of the present Protocol, except that for tankers less than 40,000 tons deadweight not fitted with tank washing machines having an individual throughput of greater than 60 cubic metres per hour, the Administration may exempt existing tankers from the requirements of this paragraph, if it would be unreasonable and impracticable to apply these requirements, taking into account the ship's design characteristics.

(e) Any existing tanker of 40,000 metric tons deadweight and upwards engaged in the trade of carrying oil other than crude oil and any such tanker of 20,000 metric tons deadweight and upwards engaged in the trade of carrying oil other than crude oil fitted with tank washing machines having an individual throughput of greater than 60 cubic metres per hour shall be fitted with an inert gas system, complying with the requirements of paragraph (a) of this Regulation, not later than a date:

(i) for a tanker of 70,000 metric tons deadweight and upwards, two years after the date of entry into force of the present Protocol; and

(ii) for a tanker of less than 70,000 metric tons deadweight, four years after the date of entry into force of the present Protocol.

(f) Any tanker operating with a cargo tank cleaning procedure using crude oil washing shall be fitted with an inert gas system..."

Inert gas systems provide protection against fire and explosion in cargo tanks by keeping the level of oxygen in the tanks too low to support combustion. They normally work by injecting cleaned gas from the ship's stack into the tank and keeping the empty space in the tank full of low oxygen stack gas so that atmospheric air does not get in.

Any discussion of this topic should begin with the note that these systems could easily be the subject of an entire conference. The system design and equipment selection process requires a great deal of knowledge and care. Deficiencies in the system can keep it from operating effectively, but they can also cause dangerous

conditions to develop. Also, a very thorough program of crew training must be carried out. The crew must be able to operate and maintain the system and also understand how the inert gas plant fits in the operating pattern of loading, discharging, tank cleaning, and other ship evolutions.

The explosion and loss of the 223,963 ton *Berge Istra* in December of last year when her inert gas system was in use has raised many questions. While there is no certainty as to the exact cause of the explosion, it appears that the blast took place in cargo tanks that were supposed to be inert. This indicates that the tank or tanks, once inerted, lost pressure and took in air. Additional emphasis is being placed on operating and monitoring procedures in an effort to prevent such conditions from occurring in other ships. The control of pressures throughout the system is crucial to preventing damaging pressure or vacuum build-ups and potential unwanted emissions of the inert gas and perhaps hydrocarbons as well.

A retrofit must be planned so that the system and its parts match the existing plant on the ship. The new system also must meet the needs of the ship's already existing set of cargo tanks. Then, the inert gas equipment must fit within the available space on the ship, and auxiliary requirements such as closed tank gauging must be satisfied. If all of the steps can be successfully carried out, then an inert gas retrofit can be accomplished. There will certainly be a number of smaller ships, particularly older ones, for which the requirement to retrofit inert gas systems will be unsupportable and which will cause them to be scrapped. A ship may be scrapped for purely technical reasons, including incompatible existing plants, or for cost reasons, where the ship's brief remaining life will not repay the investment. The cost will vary from case to case, but as an order of magnitude figure, one and a half million dollars, depending on ship size, should be representative for a foreign flag ship. American vessel costs will be higher.

In addition to the technical difficulties involved, a lack of experience with inert gas in the American market must be overcome. It will be some time before American vendors and shipyards develop the depth of experience that European suppliers have already achieved. Estimates of shipyard time for the retrofit of inert gas plants generally fall in the area of three weeks for foreign yards. There have been cases of retrofit being perfomed at sea by riding crews. American yards have in some cases indicated from six to eight weeks for installation, with correspondingly higher costs in ship's time..

A brief word about the cost of time out of service may illustrate the importance of this factor. Ships are chartered by their owners much as cars are rented, except that ships are usually operated by their owners, producing a situation analagous to chartering a bus or renting a car complete with chauffeur. The owner is paid for the use of the ship, and if the ship cannot be used because it is being repaired or modified, the owner is not paid for that time, even though he continues to incur crew costs and other expenses, including financial costs. For a large foreign tanker, costs in the area of $19,000 per day, not counting fuel, are not at all uncommon. A ship that is out of service for one extra week can easily have

lost one third of its cash flow for the year in today's low market.

The inclusion of inert gas systems on new vessels at the design stage offers the opportunity to plan the entire system for compatibility and hence to reduce the technical problems that can arise in a retrofit. The cost of installation may also be reduced with a new vessel since the piping work and installation of auxiliary equipment can be accomplished efficiently as part of the ship's construction.

To sum up, the inert gas retrofit requires a very thorough design review and may be quite expensive if there are many changes involved, whereas inclusion of inert gas in new ships can often be accomplished at a lower cost and with fewer difficulties. Crew training is crucial to safe and effective operation.

CRUDE OIL WASHING

> "Every new crude oil tanker of 20,000 tons deadweight and above shall be fitted with a cargo tank cleaning system using crude oil washing... Every existing crude oil tanker of 40,000 tons deadweight and above... may, in lieu of being provided with segregated ballast tanks, operate with a cargo tank cleaning procedure using crude oil washing."

Crude oil washing systems use fixed machines with rotating nozzles to spray crude oil on all surfaces of a cargo tank as the ship is being discharged. The crude oil acts as an effective solvent to dissolve solidified deposits of oil and sediments that settle out of a cargo during a voyage. The washing process thus reduces not only the amount of oil and deposits on the vertical surfaces of the tanks, but also breaks up the heavy sediment that could otherwise be left on the bottom of the tank and build up as sludge that would have to be removed by hand. If crude oil washing is not used, tanks must be washed with water after discharge, a process that does not clean as well as crude washing and which results in the collection of large amounts of mixed oil and water which must be separated and the oily slops retained on board.

Crude oil washing systems are relatively simple and inexpensive to install once the prerequisite inert gas system is in place. Retrofit of crude oil washing systems to ships that already have inert gas requires that fixed tank cleaning machines be installed if portable machines had been used previously, and it requires that suitable piping be provided for recirculating the crude cargo through the tank washing and discharge systems.

The other prerequisite for crude washing is proper crew training in using the system. Our experience indicates that crews can be thoroughly trained in the procedures, and the fact that crude washing is normally carried out at the discharge port means that the operation can be monitored by shorebased company personnel.

Since the crude oil washing procedure leaves the tanks far cleaner than water washing, the labor cost of tank cleaning is reduced over the water wash procedure, both in routine cleaning and in removing bottom residues in preparation for shipyard work. There is further economic benefit in the completeness of the cargo discharge, which makes the cargo space for the next trip larger. The amount of cargo the ship can carry over a period of time is increased because there is no buildup of cargo sediment in the tanks. Finally, a crude oil wash is less corrosive to the cargo tanks over a period of years than continual washing with salty sea water.

All of these factors reduce the net cost of installing a crude oil washing system. The cost of the installation itself depends on the nature of the existing tank washing equipment, but a representative cost would be about half a million dollars. This amount can be recovered through reductions in claims for cargo loss by charterers alone, without reference to the savings in labor costs over water washing and treatment of the residues.

Our own experience with crude oil washing has shown only two problems. The first is that the cargo discharge process is slowed slightly where crude washing is carried out. This means that the ship may occupy the berth for an additional four to six hours, and the scheduling of ships at the receiving facility must be adjusted accordingly.

The second problem has been that some receiving terminals, knowing the efficiency of crude washing in dissolving cargo deposits and other buildups in the tanks, have been reluctant to authorize crude washing by ships at their terminals for fear that their shore tanks would be reciving sludge and other impurities from the ship.

By and large these problems have not been serious. The added time in discharge has been very small, and the knowledge that the ship's tanks have been crude washed on previous trips satisfies most terminals that there is no great accumulation of impurities in the tanks that can be pumped ashore. The use of crude oil washing has been most successful in providing the whole range of benefits described above.

DEDICATED CLEAN BALLAST TANKS

> "Every existing crude oil tanker of 50,000 tons deadweight and above...may, in lieu of being provided with segregated ballast tanks or operating with a cargo tank cleaning procedure using crude oil washing, operate with dedicated clean ballast tanks...for the following period:
>
> (a) for crude oil tankers of 70,000 tons deadweight and above, until two years after the date of entry into force of the present Protocol; and
> (b) for crude oil tankers of 40,000 tons deadweight and above but below 70,000 tons

deadweight, until four years after the date of entry into force of the present Protocol."

As a tanker discharges its cargo of oil, the reduction in weight causes the ship to rise to the point where when all of the cargo has been discharged, the ship rides with very little of its mass below the water. This causes the ship to have part of its propeller and rudder out of the water and to be very sensitive to heavy rolling in rough seas and high winds. In order to enable the ship to ride in a more stable fashion and to be better controlled by its propeller and rudder the ship pumps in a partial "cargo" of sea water called ballast" for her trip back to a loading port.

A ship equipped with dedicated clean ballast tanks carries her ballast water in specific tanks that are reserved for that function and are not used for cargo. Ships without this feature have some ballast tanks but usually put ballast in some of the cargo tanks as well. Before being pumped out, ballast in cargo tanks must be processed to separate out and retain any leftover cargo oil that has mixed with the sea water. Since dedicated ballast tanks never carry cargo oil, the sea water in them can be pumped out without processing and without risk that any oil will be discharged. Since lines and pumps in the ballast system also serve in some cases in the cargo system, however, draining and flushing the system and particular care in properly setting valves are important.

Dedicated clean ballast tanks are easy and inexpensive to retrofit in the narrow sense of installation cost. It will be possible in many cases for owners to comply by simply rearranging existing valves and fill lines and using some designated cargo tanks for ballast only. In other cases it may be necessary to add additional valves and fill lines to provide a more positive separation between the cargo and the ballast tank systems, or to add bulkheads to divide tanks to give a proper amount of ballast capacity.

There are, however, some problems with this approach. The selection of tanks required for dedication to ballast use will reduce the cargo carrying capacity of the vessel. The loss will be considerable, up to 35% in some instances, and will be a continuing loss for as long as the vessel operates with dedicated clean ballast tanks.

The result of reduced cargo capacity is reduced earning power for the ship, and since she can carry less cargo, her operating and capital costs must be recovered with fewer tons of cargo. The ship will then have a higher cost per ton of cargo and must command a higher freight rate to break even.

Also, in most cases the use of clean ballast tanks is only effective in meeting the new IMCO regulations for a limited time. For example, for existing crude carriers of from 40,000 to 70,000 deadweight tons, clean ballast tanks are only acceptable for four years after implementation of the convention. For existing crude carriers of 70,000 dwt and above, clean ballast tanks cease to be satisfactory two years after implementation of the convention. The only type of ship for which dedicated clean ballast is an ongoing

method of compliance is an existing product carrier of more than 70,000 dwt. Though some knowledgeable sources expect the trade in products for larger ships to increase as time goes on, there are now few, if any, ships of more than 70,000 tons in the product trades.

SEGREGATED BALLAST

> "Every new crude oil tanker of 20,000 tons deadweight and above and every new product carrier of 30,000 tons deadweight and above shall be provided with segregated ballast tanks...every existing crude oil tanker of 40,000 tons deadweight and above shall be provided with segregated ballast tanks... From the date of entry into force of the present Protocol every existing product carrier of 40,000 tons deadweight and above shall be provided with segregated ballast tanks."

Segregated ballast systems are differentiated from clean ballast tank systems in having no connections of any sort between the ballast and cargo systems. The retrofitting of segregated ballast on an existing tanker requires the rearrangement of cargo and ballast valves and piping to separate the two systems entirely and may require moving or adding tank bulkheads. Considerable rerouting of the lines themselves may be necessary in cases where existing cargo lines pass through tanks newly devoted to ballast or where lines now part of the ballast system pass through cargo tanks. Also, enough new lines, valves, and pumps to fill out two separate systems will have to be installed. Such conversions are considerably more expensive to carry out than clean ballast tank arrangements. The cost will vary with the current installation on each ship; a million and a half dollars is a representative figure in some cases, and in others it will be almost twice that amount. The technical problems involved in accomplishing the change are not great, but the amount of work is substantial. Segregated ballast conversions suffer the same high penalty in lost cargo capacity as do clean ballast tank retrofits. In both cases the unit cost of cargo carried goes up for as long as the ship is in service in its new configuration.

A final problem is that the widespread use of segregated ballast will reduce the capacity of each ship so that more ships will be required to move the same volume of oil This will lead to heavier ship traffic and therefore, a greater risk of collision and other accidents.

INSPECTION AND CERTIFICATION

The IMCO Protocols adopted in February will expand both the authority and the obligations of port states, classification societies,

and flag states. States that vessels visit will have a greater ability to inspect ships and monitor compliance with international regulations. This change will be among the most important and effective measures yet adopted, for it will mean that the relatively small group of substandard ships will be subject to monitoring and enforcement at every port. It will mean that ships that do not comply will not be able to trade and survive.

The responsibilities of vessel owners and operators for compliance are primarily in the area of certificate renewals at more frequent intervals and inspection arrangements. The costs will be administrative for most responsible owners, and should not be burdensome. The requirements for more frequent inspections will place an additional load on national authorities and classification societies, but there is general agreement that the costs will not be a great burden.

The primary area in which effort will be required will be in recruiting, training, and qualifying additional personnel for the inspection needs of national authorities. It will be important to achieve consistency in the interpretation and application of the new proposals. The prime advantage of the upgrading of inspection and record keeping is that it will bring heavy sanctions to bear against substandard vessels without being a burden on responsible owners already in compliance.

The new regulations would have had a major affect on the career of the ill-fated *Argo Merchant;* her poor safety and operating record would have made her the subject of continuous surveillance, inspection, and enforcement action as she attempted to trade.

ALTERNATIVE CARGO SYSTEM REQUIREMENTS

Having examined the individual cargo system requirements and their characteristics, it will now be possible to discuss some decision scenarios to show how owners may choose to comply in cases where options are offered. Table I shows the cargo system choices to owners of existing vessels by size ranges.

Column A shows the ranges of size, and Column B shows the distinction between crude oil trade and the petroleum product trade. Though some vessels are engaged alternatively in both trades, most are regularly in one or the other. Some vessels are constrained by their characteristics in shifting from one trade to another, but most owners may make the choice between crude carriage or product movements and their respective rules. Column C shows the alternatives and their time frames, and Column D the key factors or considerations. Column E lists the courses of action where they may be considered likely. The likely results shown in Column E are not in any way presented as indicative of certainty. Each decision will be influenced by a number of factors that will be present in a different combination and given varying relative weights by the owner concerned. A partial listing of these factors is presented below, without regard to relative importance.

TABLE 1: CARGO SYSTEM DECISIONS EXISTING SHIPS

A SIZE	B TYPE (TRADE)	C REQUIREMENTS WITH OPTIONS	D FACTORS	E OUTCOME
20-40,000 DWT	CRUDE	IG req'd if high cap washing '83		
	PRODUCTS	IG req'd if high cap washing '83		
40-70,000 DWT	CRUDE	SBT +IG '83 or	Lost capacity, trade flexible	Lost capacity heavy factor unless specific need dictates & pays then SBT for long run, CBT for short
		CBT-44RS only + IG '83 or	Lost capacity only until '83 in crude	Most will go C.O.W.
		C.O.W. + IG '81	No lost capacity	Some will scrap
	PRODUCTS	SBT IG '83 or	Lost capacity, trade flexible	Some will go SBT if also in crude and will be paid
		CBT IG '83	Lost capacity, flexible to '83 in crude also	Some will scrap
70,000 DWT and larger	CRUDE	SBT IG '81 or	Lost capacity, flexible	Inert Gas req'd in any case in '81 - almost all will go to COW unless special trade
		CBT -2 yrs only IG '81 or	Lost capacity, low investment, only 2 yrs use, then only products	Some will scrap
		C.O.W. +IG '81	No lost capacity	
	PRODUCTS	SBT IG '81 or CBT IG '81		CBT cheaper, SBT more flexible Some will scrap

DECISION VARIABLES

A. Vessel Characteristics

1. Age.
2. Expected longevity, dates of next scheduled survey and drydocking.
3. Equipment installed.
4. Cargo tank coatings.
5. Number, size, arrangement of cargo tanks.
6. Cargo systems installed.
7. Versatility of vessel as configured and equipped.
8. Known required work at next drydocking.

B. Financial Factors

1. Cost of required work.
2. Availability of funds to pay for modifications.
3. Ability to finance modifications.

C. Market Factors

1. Comparative attractiveness of vessel to charterers.
2. Competitiveness in performance - speed, fuel consumption, pumping.
3. Expected demand for vessel.
4. Expected supply of competitive ships.
5. Expected rates with and without changes.
6. Market value of vessel if sold before and after.
7. Expected ability to recover investment in modifications.
8. Length of current and expected future charter commitments, if any.
9. Provisions of existing charters regarding costs and impact of new regulations.

To summarize the outcomes, the owners of most newer crude carriers will select the crude oil washing alternative as being less costly in the aggregate or scrap their ships if even the crude oil washing scenario is unprofitable. A very few may minimize their cash outlay in the short run and wait for clearer indications of future market rates by not fitting inert gas or crude oil washing, but instead trading with dedicated clean ballast tanks. They will be accepting the heavy penalty of reduced cargo capacity as a means of temporarily postponing the need to either spend money or scrap. Owners of newer product carriers may accept the added cost of segregated ballast over dedicated clean ballast tanks if they want the ability to carry crude. In all cases, there will be two certain results. Some ships will be scrapped, and transportation rates will increase.

IMPACT ON THE FLEET

Beyond the certainty that some vessels will be removed from the fleet by the new rules and that transportation costs will increase, there is little that can be ascertained clearly about the future of the existing fleet. The composition of the fleet in numerical terms and the distribution of equipment within the fleet will be the result of the many individual owners' decisions already described. Those decisions, as yet unmade, will in turn determine how much added investment must be recovered in higher transportation rates, and by affecting the supply of ships will also affect the rates themselves.

The increases in transportation costs will be brought about by several forces. The additional investments in such changes as inert gas systems and segregated ballast conversions will have to be recovered, by owners at least to some extent, if they are to continue to operate. Independent of the capital cost recovery, each segregated ballast or dedicated clean ballast conversion will require that the routine operating costs of the vessel be allocated over a smaller number of tons of cargo than before conversion, thus raising the transportation cost per ton even farther.

The trend toward early scrapping of some older ships may lead to the conclusion that the new regulations will hasten the transition to new ships. This conclusion is neither as accurate nor as simple as it may seem. There is no doubt that the new regulations will cause the demise of some decrepit ships and make the remaining ships more expensive. Since retrofitting features is generally more expensive than incorporating them in new ships, and since the investment recovery time is shorter, the cost of specific mandated features will be higher for existing ships than new ships. However, the current oversupply of tankers in most size categories has reduced the prices for existing ships dramatically. Relatively new ships acquired during this period will require very modest annual amortization payments. New ships, as defined in the protocols, will still be comparatively quite expensive. So expensive in fact, that it appears likely that having once been able to make an investment to achieve compliance with the new standards, the owner of an existing ship may well be justified in investing additional money later to keep his existing ship in service. The higher rate needed to pay off his investment will still not approach the rate that would be required by a new ship. Thus, although the implementation of the new regulations will assist in retiring old ships, it will probably not be a strong enough factor by itself to tip the balance of supply and demand toward new ship transportation rates.

IMPACT ON VESSEL OWNERS

On this topic the key problem lies in the independent fleet. Owners who have long term charters that require them to keep their vessels in compliance with applicable regulations may be in a difficult position. A conversion to segregated ballast or dedicated clean

ballast tanks will mean a reduction in cargo carrying capacity. It is by no means clear how this reduction will be treated by charterers, and the answer will depend not only on the wording of the charters and the interpretations of arbitrators and legal experts, but also on the relationships between owners and charterers. The changes will be implemented over a period when most observers expect the market for tankers to be either still depressed or coming toward a balance. Owners will in almost all cases be in a weak bargaining position. How many businesses can sustain a loss of 30% of their revenue with little or no decrease in expenses and survive?

The long term effect will be that capital costs and operating costs will be higher and if owners are to continue they will have to charge higher rates without increasing their well being. The costs will have to be included one way or another in the delivered cost of their cargo.

COST RECOVERY

The answer to the question of whether owners will be able to recover the costs of new pollution regulations will come piecemeal, on an individual basis. But clearly those who cannot will not survive. If they do not survive, the services they provided will be performed by the oil company fleets or by other owners able to pass along the cost. And who will ultimately absorb the added cost? Those who buy the products made from the oil, the consumers of the world.

BENEFITS OF THE RULES

It is fair to ask what the effect of the changes will be on oil pollution and what benefits will accrue from the new changes. The context necessary to establish this picture is being provided more precisely in other papers, but some general background is necessary here. One estimate has held that in 1973, before crude oil washing was practiced on any sizable scale, operational discharges at sea accounted for about 18% of the 6.1 million tons of oil that entered the oceans: about 1.2 million tons. An Exxon estimate of the benefit if crude oil washing were adopted by all tankers of over 70,000 tons is that

> "relative to present operations in excess of 1.1 million tons per year of operational discharges will be saved at a nominal cost per ton of $310."

Likewise, "with retrofitted segregated ballast alone, and with estimated fleet capital costs of about $4 billion, there is an estimated saving of less than 1.0 million tons... or roughly $4,210 per ton, a cost over 13 times that for crude oil washing" (Exxon Corp., 1978).

As mentioned, there are almost no tankers of more than 70,000 tons carrying products; almost all carry crude and are eligible for the crude oil washing alternative. We have already seen that almost all that remain in service will be fitted with crude oil washing rather than using dedicated clean ballast tanks or segregated ballast. The effect of crude oil washing in reducing operational pollution will therefore be substantial. Segregated ballast in new tankers will also be of benefit, though some tank cleaning will still be required. The impact of new national monitoring and international support of these requirements as well as safety measures will be a second major contributor to cleaner seas.

The value of safety measures designed to reduce accidental discharges is less easily quantified. The 1973 National Academy of Sciences report, "Petroleum in the Marine Environment" estimated that the amount of oil discharged in ship accidents is only one-sixth the amount of routine operational discharges and constitutes only 3% of the petroleum entering the oceans. While this source of pollution is subject to a certain amount of corrective control, the corrective action has to be reviewed in light of its cost and its expected benefit. The improvements in inspection and survey authority will assist in controlling and weeding out substandard vessels, and will thereby make a considerable contribution to safety and may also reduce the number of ships with poor operating practices. Point by point review of the safety-related equipment rules has shown that responsible operators already comply with most of the new rules.

A major question to be asked is what can be expected in the area of accidental dischages and their control. In my view, the answer lies in the Coast Guard statistics that more than eighty-five percent of all accidents are the result of human failure (United States Coast Guard, 1974). This pattern is not new and continues to be a key element in any effort to reduce pollution.

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Haimbaugh: Our next speaker is Mr. Carlton Russell. He is an attorney at law in Long Beach California specializing in admiralty and maritime law. He is a graduate of the Coast Guard Academy and holds the role of Captain in the Coast Guard reserve.

LIABILITY AND DAMAGE COMPENSATION FOR TANKER OIL SPILLS

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ABSTRACT: This paper presents an overview of the law governing liability for oil spills from tankers and existing regimes for compensating the injured parties. Broad in scope, it is prepared for a symposium on the politico-economic-environmental problems arising from transportation of oil by ocean tankers.

While oil pollution from tankers is the subject, there is growing evidence that discharges of other cargoes into the oceans may have an even more deleterious effect on the marine environment. If so, the issues and concepts for liability and damage reparations remain the same. Insideously, the basic difference is that these other pollutants and their damage are often invisible until it is too late for remedial action.

Many of the attendees at this symposium witnessed, even shaped, the trend of tanker operation from a rather unregulated industry to one confronted by a maze of conflicting laws and regulations at the international, national and port state level. An assessment of what is yet to be done, and undone, is offered.

INTRODUCTION

"Like spilt milk, spilt oil cannot be undone" (1). It can, however, be contained and cleaned up and payment made for the damage suffered. Who pays, under what circumstances, and how much is the subject of international, national and local debate.

The United States is dependent upon oil for its economy and national defense. Much of it is transported across the oceans by tankers of foreign flag. Maritime law, perhaps the oldest form of international law, was created to accomodate trade and commerce. Uniformity is its pole star, facilitating the free flow of vessels across the seas to load and discharge cargo in the ports of the world.

Why have efforts to achieve uniformity in laws affecting oil pollution from tankers been increasingly thwarted in the last ten years? The short answers are *Torrey Canyon, Tamano, Zoe Colocotroni, Argo Merchant* and *Amoco Cadiz,* as well as a host of other avoidable major oil spills.

Seafaring men know that almost all serious pollution of the oceans by oil can be avoided by competent crews using prudent seamanship aboard tankers that are reasonably fit to carry a potentially dangerous cargo. When corners are cut, casualties follow. Then, and only then, do questions of who is liable to injured parties for the resultant damage arise.

Spills of great magnitude are needless, costly and destructive. They inflame the public and affect the attitude of lawmakers and judges. They spawn the massive explosion of laws affecting tanker operation at all levels of government, as well as international conventions. States from Maine to Alaska have created their own layers of regulation, with varying degrees of conflict with the federal scheme.

While casualties are the attention getters, they account for less than 30% of oil spilled by tankers. Most tanker oil pollution is intentional and clandestine, the result of bilge pumping and tank cleaning. Space age technology to detect and identify these polluters is not fully implemented to this important task. Detection of intentional spillers will need to be more vigorously pursued to even approach oceans free of oily discharges.

To state the obvious, if the detection of the source of pollution fails, liability can not be established. Despite the host of changes in water pollution law, ten years after *Torrey Canyon* the damage caused by the undetected polluter is still almost totally uncompensated under federal law (2).

NATIONAL POLICY

Since 1970 it has been the policy of the United States that there shall be no discharges of oil or hazardous substances into our waters (3). States with similar concerns raced to enact their own laws. Congress steadfastly refused to preempt the states from imposing liability standards on oil tankers using their waters (4).

Chaos followed. This chaos can be corrected once an adequate federal program is enacted and operating. That moment may be near, but has not yet arrived, as we shall see.

JURISDICTION

If a spiller is known, liability claims for pollution damage may be prosecuted in the U. S. District Courts, (5) even when the damage occurs ashore (6). If claims are filed in state court they are usually removed to federal court (7).

Under the recent amendment to the Outer Continental Shelf Lands Act, an injured party may elect to proceed administratively against the $200 million Offshore Oil Pollution Compensation Fund if the spill occurs from a tanker transporting oil directly from an offshore facility. This Fund may then seek reimbursement and attorney's fees (8). Even so, with double digit inflation, identified polluters and their underwriters may too easily decide that delay and litigation are in their economic best interest, rather than prompt payment of claims.

DUTIES AND SANCTIONS

The discharge of oil in harmful quantities (9) is prohibited in the navigable waters of the United States, the contiguous zone and offshore waters where natural resources are under the exclusive management authority of the United States (10). The prohibition extends from the coastline to at least 200 miles offshore (11).

(a) Duty to Report Spill

Once a tanker spill occurs it must immediately be reported to the U. S. Coast Guard by the person in charge (12). At sea this will be the master, but during transfer operations in port it may be the chief mate, mate-on-watch, or pumpman. Shoreside supervisors at terminals and refineries have the same duty to report.

(b) Crime Not to Report

Failure to make the report is a crime. It is punishable by a fine of up to $10,000 and imprisonment for one year (13). A corporate person in charge may be subject to criminal conviction where the employee does not report the spill (14). This sanction enables the Coast Guard to receive notice of spills that might otherwise go unreported and ignored.

(c) Civil Penalty

The owner, operator or person in charge shall be assessed a civil penalty up to $5,000 for each spill (15). Consequently, it is a crime not to report a spill and an automatic penalty when the re-

port is made. This "catch 22" has been upheld in the courts (16). A tanker may be required to post a bond to secure payment of the penalty before it can sail (17).

Liability for a penalty is absolute. The Coast Guard will accept no defenses or excuses for an oil spill, but, depending upon several factors, the penalty can be compromised to a sum well below the $5,000 maximum (18). In one case a federal court, on appeal, reduced the assessed penalty to a sum of $1.00 on a *trial de novo*.(19).

(d) Foreign Flag Tankers

Foreign flag tankers are exempt from reporting requirements and civil penalties if the spill occurs more than 12 miles off the United States coastline and they are not "otherwise subject to the jurisdiction of the United States" (20). These tankers are not exempted from liability to the United States for costs of removal of oil spilled as far as 200 miles at sea, including the cost of restoring or replacing natural resources that are damaged or destroyed by the spill (21). This, of course, presupposes that jurisdiction can be acquired over the tanker and its owners.

INTERNATIONAL AGREEMENTS

The United States has jurisdiction to regulate the operation of tankers under U.S. flag throughout the world. Foreign flag tankers are subject to United States control when they call at U.S. ports. Even far offshore the United States asserts a claim of some jurisdiction (22).

Since much of the oil upon which the United States depends is delivered in foreign tankers, a keen incentive exists to reach international agreement on the standards for liability and compensation for damage from tanker oil spills, regardless of flag.

To this end, the United States participates in the Intergovernmental Maritime Consultative Organization (IMCO), a special maritime agency of the United Nations (23). Since its creation in 1948 a total of 18 conventions have been ratified by the United States. Of these, however, only one has any real impact on the remedial options that may be taken once a spill occurs. This convention is the 1969 Intervention on the High Seas in Cases of Oil Pollution Casualties, (24) which came into force in 1975. It ratifies the action taken by the United Kingdom in attacking the stricken *Torrey Canyon* with aircraft in an effort to reduce the pollution threat, an action taken without the consent of the *Torrey Canyon's* owner, cargo interests, underwriters, or the Government of Liberia, whose flag flew over the tanker. The pragmatic remedy to a pollution threat by destruction of the source is now condoned by international agreement.

The United States took control of *Argo Merchant* under authority of the Convention in December, 1976 (25). In the event of imminent danger of pollution after a casualty, the United States may prevent, mitigate or eliminate the threat, even by destruction of the tanker.

Recently the Intervention Convention was the basis for a leaking tanker being sunk at sea after it was denied entry in English and Irish ports.

Despite the urging of the State Department, as well as shipping, oil and other interests, (26) two other conventions have not been ratified by or implemented in the United States. These set standards and limits on liability for oil spill damage claims that are considered too low to gain Senate support (27).

DOMESTIC APPROACH

A tanker's liability for clean up and restoration costs is set forth in Section 311 of the Federal Water Pollution Control Act (28). The evolution of this Act is a study of liability trends in the United States. For centuries the basic law of recovery for tort damage was negligence, with the claimant having the burden to establish that the tort-feasor was at fault in not using reasonable care to avoid damage. This "fault" concept has now given way in many states to "no fault" auto accident reparations.

Liability without fault has been embodied in maritime law since the turn of the century. Ship owners owe their crews the duty to furnish a seaworthy vessel. This duty can not be avoided or delegated. Unseaworthiness of a vessel means absolute liability of the owner for injuries suffered by a crewmember (29).

Conversely, tanker owners had very lax standards for oil pollution until quite recently. In 1966 a tanker owner was not responsible for the cost of removing oil after a spill unless it was caused by "gross negligence" or if it was a "willful spill" (30). *Torrey Canyon,* followed by the blowout in Santa Barbara channel, changed all that.

STRICT LIABILITY FOR OIL SPILL CLEAN UP

In 1970, after two years of political give and take, Congress imposed strict liability for clean up costs on dischargers of oil into the nation's waters (31). Strict liability means that the polluter, if detected, is responsible for the cost of cleaning up an oil spill unless the spill was caused by:

(1) act of war;
(2) act of God;
(3) governmental negligence in failing to maintain adequate aids to navigation; and
(4) act or omission of a third party.

Liability is not absolute. The Coast Guard was challenged in the *M/V Tamano* spill after the vessel discharged bunker C into Casco Bay. Owners sought to avoid payment of the clean up costs on the ground that a buoy was off station, puncturing the hull of the inbound tanker. At trial, the owners prevailed (32). On appeal,

the judgment was reversed and the pilot of the tanker found solely at fault. Owners then argues this fault was the act of a third party, a basis for avoiding clean up costs (33). While rejecting this, the court indicated the the owners might seek indemnity against the pilot, even though the "act of a third party" defense did not apply to the clean up expenses.

LIABILITY FOR REMOVAL AND RESTORATION COSTS

Owners are encouraged to undertake the cost of clean up of their oil spills. Many do. The oil industry has formed cooperative ventures, stockpiled booms and other equipment and created elaborate command posts in the major ports of the United States. The oil companies are sensitive to public opinion. If a tanker spill occurs within an oil company's fleet, the clean up task is usually undertaken with vigor and dispatch (34). Containment equipment is made available for Coast Guard contracted clean up as well.

Too often, abatement and removal of an oil spill is not immediately and effectively undertaken by the spiller. In this event, the Coast Guard is authorized to do so and seek reimbursement from the tanker and its owners (35). Since the Clean Water Act of 1977, these costs may include restoring or replacing the affected natural resources.

Just as clean up is not always undertaken voluntarily, payment of clean up costs and damage claims is sometimes resisted, even where it is obvious the tanker is liable. Take, for instance, the ill-fated *Zoe Colocotroni*.

In March, 1973, *Zoe Colocotroni* departed Venezuela with more than 180,000 barrels of crude oil, bound for Puerto Rico. The tanker became lost and ran aground 3 miles off the picturesque village of LaPaguera. Accidents happen. This one was aided. *Zoe Colocotroni* lacked a detailed chart of the waters off Puerto Rico. Its gyro course recorder, fathometer, radio direction finder and radar were not operating properly. It had no tide tables whatsoever (36). Owners, in daily contact with the tanker, did nothing to remedy these handicaps to safe navigation. One wonders what the cargo owners did, or didn't do, in selecting this tanker for the carriage of their oil.

Once aground the master took remedial action. Although the grounding had not ruptured any tanks, nor caused any pollution, it was impossible to refloat the tanker without reducing its displacement. Consequently, without seeking any assistance, the master pumped more than 5,000 tons of crude oil into the adjacent waters of the Caribbean. The tanker refloated without serious difficulty, leaving a major oil spill in its wake. The Coast Guard dispatched a strike team and expended more than $600,000 in clean up costs. Voluntary payment of these costs was not forthcoming.

The incompetent seamanship on *Zoe Colocotroni* before the casualty was followed by legal maneuvering and delay after the spill. Underwriters and lawyers took over the helm, setting a course to avoid

the oncoming claims. The trial judge described the conduct of the defendants as "deliberately obstructive, and most probably also contumacious," (37) noting that the Coast Guard filed to obtain voluntary payment of clean up costs after "tedious and frustrating negotiations with the underwriters" (38).

Eventually, at trial, the Coast Guard recaptured the funds expended in clean up. The owners and underwriters put on no defense, assenting to summary judgment in favor of the United States. Strict liability for clean up costs can be slow in fruition, despite the clear mandate of the law.

Meanwhile, back at the spill, the flora and fauna were faring no better. Puerto Rico did arrest the tanker and the master after refloating. Suit to recover the resource damage to the mangrove swamp and marine organisms was filed. At trial, damages were awarded against owners and underwriters in the amount of $6.1 million (39). Owners and underwriters are appealing.

Ordinarily the payment of clean up costs and spill damage claims is an insurance matter. Liability insurance is often furnished by English clubs, associations of shipowner members.

Zoe Colocotroni was an older tanker, built in 1953. It was homeported in Greece, registered in Panama and controlled by two corporations, one Greek and one British. E.M.J. Colocotroni, manager of the British corporation that controlled the crew and outfitting of *Zoe Colocotroni*, was a member of the Board of Directors of the West of England, the club that insured *Zoe Colocotroni*. The closeness of a shipowner and his underwriter could not be more clearly illustrated.

The irony of this major oil spill is twofold. First, five years earlier a near namesake, the tanker *General Colocotronis*, grounded on a reef in the Bahamas, with 92,000 barrels of Venezuelan crude in her tanks. A skillful salvage master pumped 95% of the cargo into an empty tanker brought to the scene and had the stricken tanker towed to safety without incident. Second, no legal remedies for recovering clean up costs under *strict liability* were in force to induce this effort.

The oil industry supports the *strict liability* concepts today, provided the defenses of act of war, act of God, governmental negligence and act of third party are retained. Virtually no one seeks a return to the negligence or fault standard. There are advocates of absolute and unlimited liability for oil spill clean up costs and damage, believing this would furnish a strong incentive for the use of utmost care in avoiding spills(40).

LIMITS ON LIABILITY

Tanker liability for spills, with some exceptions, is limited. The cost for payment of oil removal and restoration or replacement of affected natural resources is limited to a dollar per gross ton formula, recently raised to $150 per gross ton, with a $250,000 minimum (41). This is approximately the same formula in the International Civil Liability Convention (42) which has not been ratified by the United States.

The massive *Amoco Cadiz* spill which fouled the beaches of France will far exceed this formula in costs of clean up. *Amoco Cadiz* was a Liberian tanker. Both France and Liberia ratified the Civil Liability Convention. Reportedly, the damage claims exceed $500 million. Confronted with a limit of $17 million under international agreement, France may exhibit a greater concern for oil spill damage reparations in future IMCO and Law of the Sea negotiations.

PROPERTY DAMAGE CLAIMS

Strict liability is not the test for property damage claims in the United States, insofar as federal law is concerned. Claims of oil spill damage to property are brought on the more traditional grounds of fault, nuisance, *res ipsa loquitur* and statutory violation.

After a major spill, property owners, fishermen and coastal businesses often form "classes" (43). In defense of these claims, tanker owners and underwriters turn to their old ally, the Limitation of Liability Act of 1851 (44).

Maritime law permits a shipowner to limit his liability to the value of the vessel at the end of the voyage, so long as the cause of a casualty leading to the spill was shipboard negligence not within the "privity and knowledge" of the owner. This concept has been criticized for years by law commentators and judges. Congress, rather than repeal or amend it, has chosen to write it out of pollution statues for clean up costs and restoration of resources (45). Nevertheless, it remains available in defense of property claims.

HOW LIMITATION MAY APPLY

In the *Argo Merchant* oil spill the shipowner has petitioned to limit its liability in a New York court. This action stalled all of the claims of damage asserted by fishermen and property owners in the Massachusetts courts. If the petition is granted, the shipowner's liability to all these claimants will be the value of the wrecked tanker, or almost zero.

Union Oil Company attempted to limit its liability in the *Torrey Canyon* grounding. As a time charterers it could not, since the defense is available only to owners and bare boat characterers. Union Oil then tried to pierce its own corporate veil to gain standing as the true owner, a status it had sought to avoid through management and time charter documents (46). Similar efforts to limit liability have been asserted in other oil spill cases where the damage claims far exceeded the value of the vessel after the asualty.(47).

Piecemeal elimination of limits of liability to damaged parties that are based upon the value of the tanker after the casualty has begun. This limitation does not apply to spills covered by the

Alaska Pipeline Act (43 USC Sec. 1651, *et seq.*), the Deepwater Ports Act (33 USC Sec. 1501, *et seq.*), or the Outer Continental Shelf Lands Act pollution fund (43 USC Sec. 181 *seq.*). A *Superfund* (48) for all vessel pollution, if enacted, most likely will place limitation on a dollar per gross ton formula, with a minimum amount, instead of the post casualty value of the tanker.

POLLUTION FUND

Under the Water Quality Improvement Act (Section 311 of the Federal Water Pollution Control Act) a "revolving fund" of 35 million dollars (49) was established to pay for United States efforts to either oversee an oil spill clean up undertaken by the spiller or to initiate and pay for governmental clean up costs. The administration and supervision of the fund rests with the U.S. Coast Guard. The fund is designated to be self-sustaining, or revolving, through recapture of monies from:

(1) spillers who were found liable for clean up costs;
(2) civil penalties against dischargers; and
(3) fines for failing to report spills.

Recapture of monies for the Pollution Fund has been difficult. Only 31% of the spillers were even identified in oil spills where the fund was used for clean up in 1972-1973, and reimbursement was obtained in only 8% of the "known incidents" (50). This is partially explained by delays in getting a court judgment when the polluter denies liability (51).

When the magnitude of an oil spill exceeds the gross tonnage liability of a vessel there is no incentive to undertake clean up expense and the task is left to the United States (52).

AVAILABLE INSURANCE

Tanker owners claim they are unable to obtain unlimited coverage in their insurance for oil pollution damage. The reasons offered are varied, but generally the change from a fault to a strict or absolute liability standard is blamed, coupled with loss of the defense of limitation of liability to the value of a vessel after the casualty. Potential damage from an oil spill can be enormous, the risks are not easy to predict.

In the hearings leading to the Water Quality Improvement Act of 1970, Congress was told the most oil spill insurance that could be found was $14.4 million (53). Nevertheless, insurance limits expanded from $14.4 million in 1970 to $25 million for the 1974-75 policy year with little or no increase in cost to shipowners (54). The limit was lifted to $50 million in 1978.

PROOF OF FINANCIAL RESPONSIBILITY

To secure payment of clean up costs all tankers over 300 gross tons entering United States ports must have evidence of financial responsibility (55). This is achieved by having evidence of insurance, guarantee, surety bond, or through qualification as a self-insurer. Tankers may be denied entry into U.S. ports, and detained if about to depart, if this evidence of financial responsibility is not on board or otherwise available.

VOLUNTARY AGREEMENTS

Tanker owners and oil companies have entered into voluntary agreements to pay for damages caused by oil spills under certain circumstances. These agreements are to meet the objectives of the IMCO conventions. In 1969 TOVALOP (Tanker Owners Voluntary Agreement Concerning Liability for Oil Pollution) was adopted to furnish a mechanism for oil spill clean up, but not for payment of property damage claims. CRISTAL (Contract Regarding an Interim Supplement to Tanker Liability for Oil Pollution), formed by oil companies, provides compensation for third party damage where the shipowner is liable under CLC, the International Convention on Civil Liability for Oil Pollution Damage, 1969.

Many maritime nations have ratified the Civil Liability Convention on Oil Pollution Damage (CLC) and it has been in force since 1975. It makes a tanker liable for clean up costs and third party damage, up to a maximum of $16.8 million. The United States has not ratified the Convention because the limit of liability, which includes owner-incurred cost of clean up, is too low.

Under CLC the liability is strict. The defenses permitted are:

(1) act of God;
(2) act of war;
(3) intentional act of third party; and
(4) sole negligence of government in maintaining navigational aids.

The CLC is not applicable to the shores and waters of the United States since it has not been ratified by the United States.

RECOVERY OF TANKER EXPENDITURES

Where the tanker owner or operator incurs clean up costs, these may be recovered in the Court of Claims upon proof that the spill was caused by an act of God, act of war, negligence of the United States, or an act of a third party (57). Indemnity may be obtained from the party causing the spill, even where the act of third party defense is unsuccessful (58).

STATE LAWS

States bordering the United States have enacted their own laws affecting tanker spills, often in conflict with the federal scheme and encouraged by the refusal of Congress to preempt the field. Florida's effort made liability unlimited, in conflict with federal law. It withstood an early test on constitutional grounds and was upheld by the U.S. Supreme Court (59). Washington and Alaska pollution law is under attack (60), and statutes imposing absolute and unlimited liability exist in most states bordering our oceans.

SUPERFUND

An effort to consolidate the various funds established by federal and state laws into a single $200 million fund to pay for all damage of any oil spill from any source nearly emerged from the 95th Congress. The House of Representatives passed a National Oil Spill Liability and Compensation Proposal, H.R. 6803, 95th Congress, and the Senate considered a somewhat similar bill, S 2083, which did not preempt state laws governing oil spill liability. Amendments to H.R. 6083 passed the Senate on October 6, 1978, but did not survive the deliberations of the conference committee.

Some version of a *Superfund* seems likely to become the next major United States law to govern liability for the damage caused by an oil spill. The concept has the support of the oil and shipping industries *if* it preempts the federal and the state funds and liability laws now in force (61). Preemption of state laws seems unsatisfactory to the Senate, setting the stage for a major House/Senate battle in the 96th Congress.

The status quo has critics from all quarters. The oil and shipping interests, augmented by the marine insurance industry, seek to:

(1) keep liability within claimed limits of oil pollution insurance coverage;
(2) preempt state laws on pollution liability and the pollution funds into a *Superfund* administered by one agency, presumably the Coast Guard; and
(3) preservation of at least the defenses of act of war, act of God, negligent and intentional acts of third parties.

Other interests assert the need for unlimited and absolute liability for all oil spill damage, to give incentive for the use of utmost care in the carriage of oil. Every time the air clears for deliberation, a new tanker casualty, such as *Argo Merchant* and *Amoco Cadiz*, charges the atmosphere. A *Superfund* approach would, in any event, give innocent victims of oil spills

a speedier and more economical means of recouping their damage than now available.

GOALS YET TO ACHIEVE

1. To complete the regime for tanker oil spill liability and damage payment a fund is needed to compensate any person who suffers damage to real estate, personal property or income as a result of an oil spill. Litigation, even in class actions, is too slow and too expensive for innocent victims of oil spills to be fairly compensated by resort to the courts.

2. A greater effort must be asserted to detect clandestine spills and to identify their source, using all available technology. Otherwise a *Superfund* will simply pass the cost of damage claims on to the consumer by repeated assessments of transfer fees on oil in transit to replenish the fund.

3. The civil penalties for discharges should be greatly enlarged from the $5,000 maximum. This increase, coupled with complete flexibility to mitigate the sum according to the circumstances, would help in various ways. Failure to undertake clean up should be a major factor in imposing the maximum penalty. The present penalties, while automatic, are quite inadequate to deter carelessness. Their low magnitude make clandestine spilling well worth the economic risk of detection.

4. Criminal sanctions for failing to report spills should be vigorously pursued, to discourage the failure to report spills immediately.

5. Within the Coast Guard and Department of Justice a legal task force should be created to recapture aggressively any expenditures from a *Superfund* from the responsible spiller. This regime, coupled with significant civil penalties and criminal sanctions, will give oil spillers an incentive to initiate their own clean up and payment of claims after the spill, and to use great care to avoid spills in the first place.

6. Publication of an annual report, identifying the owners and operators of tankers and cargoes involved in significant oil spills. Private organizations abound to analyze the data to furnish the American public with the names of the chronic offenders, a so-called "dirty dozen." In this way, public awareness may exercise its own economic sanctions against the polluters of the oceans and their cargo owners.

7. Impose liability on cargo owners for oil spill damage in those casualties where the tanker was not properly equipped or manned, or where a clandestine spill is not reported. This sanction will inspire greater care in the selection of tankers for charter

by imposing liability on cargo owners for the damage caused by the corner-cutters and sloppy operators.

8. Congress should preempt state funds and federal funds, as well as state liability law, to achieve national uniformity once a workable and adequate federal regime is established.

The standards for oil spill liability and any limits of liability should be uniform throughout our own country, even if not in perfect harmony with the international provisions of the Civil Liability and Fund Conventions. The danger of entrenching bureaucratic oil spill regimes in the several states, impeding the flow of commerce, can be avoided once an adequate federal program is established and implemented.

CONCLUSION

The most effective way to prevent oil spills is to make each of them subject to swift, certain and effective action for civil penalties, clean up costs and the payment of all damage claims. The *Superfund* approach is vulnerable in this regard. Spillers may sit back and let the fund bear the expense of remedial action and claims payment, then fight a rear guard legal battle in the hope that recapture of the expended monies will not be vigorously and effectively pursued by the fund.

The STRIKE FORCE concept should not stop with cleaning up the mess and assessment of the ecological damage. Unless there is vigorous and effective effort to recapture the fund expenditures from the spiller, the economic incentives for the spiller to take charge are lacking, even where the clean up and damage claims are within the limit of tonnage liability. In massive spills, where clean up costs exceed the liability, the owner is without any incentive to undertake this expense. A civil penalty of high magnitude in these cases is clearly needed. To achieve the national policy that tankers discharge no oil into our waters it is vital that *economic deterrence* for oil spillers be woven into the fabric of any *Superfund* administration.

"Like spilt milk, spilt oil cannot be undone," the Houston Marine Insurance Seminar is told (61). Conversely, oil not spilt is never the subject of damage claims, resource destruction or clean up costs. The national goal of no discharges of oil into the sea around us is achievable if tankers are properly outfitted, maintained and operated. Greater care in tanker selection by cargo owners, with incentives and support from underwriters, would be a giant step toward this goal, while eliminating the need for the proliferation of laws and regulations that have engulfed the tanker industry.

FOOTNOTES

1. Buglass, L. J., The Big Oil Spill: Potential Liabilities vs. Available Insurance, Twelfth Annual Houston Marine Insurance Seminar, September, 1977.

2. Funds have been established under the Trans-Alaska Pipeline Authorization Act, 43 USC Sec. 1651, *et seq.;* the Deepwater Port Act, 33 USC Sec. 1501, *et seq.*, and the Outer Continental Shelf Lands Act as amended in 1978, 43 USC Sec. 1811. Many states have created funds such as Maine's $4 million fund upheld in *Portland Pipeline Corp. v. Environmental Protection Board,* 307 A.2d 1 (Me 1973), appeal dismissed, 414 U. S. 1035, (1973).

3. 33 USC Sec. 1321 (b) (1).

4. 33 USC Sec. 1321 (o) (2).

5. 28 USC Sec. 1331-1333; 43 USC Sec. 1333 (b).

6. Admiralty Extension Act of 1948, 46 USC Sec. 740.

7. 28 USC Sec. 1441, *et seq.*

8. 43 USC Sec. 1819; the mechanics of this fund administration are still in the formative stage.

9. Defined in 40 CFR Part 110.3. The "sheen test" was upheld in *United States v. Boyd,* 491 F-2d 1163, (9th Cir. 1973).

10. 33 USC Sec. 1321 (b) (3).

11. Exempted are the discharges permitted by the International Convention for the Prevention of Pollution of the Sea, 1954. Enforcement beyond the contiguous zone is fraught with international legal problems beyond the scope of this paper.

12. 33 USC Sec. 1321 (b) (5).

13. Id.

14. *Apex Oil Co. v. United States,* 530 F.2d 1291, (8th Cir. 1976).

15. 33 USC Sec. 1321 (b) (6).

16. *United States v. LeBoeuf Bros. Towing Co., Inc.,* 537 F.2d 149, (5th Cir. 1976) *cert. den.* 430 U. S. 987 (1977).

17. 33 USC Sec. 1321 (b) (6). *California v. SS Bournemouth,* 307 F. Supp. 922 (C.D. Cal. 1969).

18. Guidlines are set forth in 33 CFR Part 1.07 and Commandant Instruction 6922.11A (Coast Guard). This procedure is undergoing changes to avoid "due process" problems. Apparently an administrative proceeding in conformance with the Administrative Procedure Act, 5 USC Sec. 551, *et seq.*, has been considered and rejected.

19. *United States v. General Motors Corp.*, 403 F. Supp. 1151, (D. Conn. 1975); cf. *United States v. Atlantic Richfield Co.*, 429 F. Supp. 830, (E.D. Pa. 1977).

20. The limiting language "otherwise subject to the jurisdiction of the United States" is present in 33 USC Sec. 1321 (b) (5) and (b) (6) and is not in 33 USC Sec. 1321 (f) (1) and (f) (4).

21. 33 USC Sec. 1321 (b) (5) and (b) (6).

22. 33 USC Sec. 1321 (f) (1) and (f) (4).

23. See Silverstein, H. B., *Superships and Nation-States;* the Transnational Politics of the Intergovernmental Maritime Consultative Organization, 1978, Westview Press.

24. 21 IEG 1301, 91 LM 25.

25. The Convention is implemented in the United States by 33 USC Sec. 1471, *et seq.*

26. See *Tanker Safety and Environmental Protection.* Exxon Corporation, January, 1978, p.9, Menton, O.R., Superfund - The National Oil Spill Liability and Compensation Proposal, Twelfth Annual Houston Marine Insurance Seminar, September, 1977; Healy, N.J. and Paulsen, G.W., Marine Oil Pollution and the Water Quality Improvement Act of 1970, 1 *Journal of Maritime Law and Commerce.* No. 4, pp 537-572.

27. See Healy, N.J., The International Convention on Civil Liability for Oil Pollution Damages, 1969, 1 *Journal of Maritime Law and Commerce.* No. 4, pp 317-325.

28. 33 USC Sec. 1321.

29. *The Osceola*, 189 U.S. 158, 23 S. CE. 483 (1903).

30. Public Law No. 89-753 (Nov. 3, 1966), see 33 USC Sec. 432-3 (Supp. IV 1969).

31. Public Law No. 91-224 (Apr. 3, 1970) known as the Water Quality Improvement Act of 1970, repealing the Oil Pollution Act of 1924 and amending the Federal Water Pollution Control Act.

32. *Burgess v. M/V Tamano*, 373 F. Supp. 839, (D. Maine 1974).

33. *Burgess v. M/V Tamano*, 564 F.2d 964, (1st Cir. 1977).

34. Standard Oil paid far more to clean up the oil list as a result of the *Arizona Standard/Oregon Standard* collision in San Francisco Bay than was required by law.

35. 33 USC Sec. 1321 (c) (1), (f) (1).

36. See *United States v. M/V Zoe Colocotroni*, 456 F. Supp. 1327, 1333 (D. Puerto Rico 1978) for the unhappy state of affairs.

37. *Puerto Rico v. SS Zoe Colocotroni*, 456 F. Supp. 1327, 1331 (D. Puerto Rico 1978).

38. *United States v. M/V Zoe Colocotroni*, 456 F. Supp. 1327, 1348 (D. Puerto Rico 1978), fn, 47.

39. *Puerto Rico v. SS Zoe Colocotroni*, id., note 36. For the nature of resource damage from oil see also: Gundlach, E. R. and Hayes, M.O., Vulnerability of Coastal Environments to Oil Spill Impacts, 12 *Marine Technology Society Journal*, Aug. - Sept., 1978, pp 18-27.

40. See Lipeles, M., Oil: Study of Pollution Insurance Liability Laws, Environmental Policy Institute, 1977, p. 351.

41. Clean Water Act of 1977, 33 USC Sec. 1321 (f) (1).

42. International Convention on Civil Liability for Oil Pollution Damage (Brussels, 1969), 21 IEG 1501, 9 ILM 45.

43. Rule 23, Federal Rules of Civil Procedure.

44. 46 USC Sec. 181, *et seq.*

45. Trans-Alaskan Pipeline Act, Deepwater Ports Act, Outer Continental Shelf Land Act, and Clean Water Act of 1977.

46. Gilmore and Black, *The Law of Admiralty*, pp 841-843.

47. *In Re Harbor Towing Corp.*, 335 F.Supp. 1150 (D. Md. 1971). *In Re Oswego Barge Corp.*, 439 F.Supp. 312 (N.D.N.Y. 1977) (a tug and barge spill in the St. Lawrence Seaway); *Ocean Eagle*, 1974 AMC 1629 (D.P.R. 1974).

48. As used in this paper, *Superfund* refers to a concept of one federal fund for compensating all damage claims and expenses of clean up and restoration of resources caused by oil spills, funded by a transfer fee on movement of oil,

and preempting all other federal and state funds. See H. R. 6083, 95th Congress, for example.

49. Congress only appropriated $20 million then added $10 million more in 1976 when the fund was depleted to $1 million. Public Law 94-134.

50. Van Voorhis, P., "Pollution Fund Statistics," Memorandum to Chief of Marine Environmental Protection Division and Chief of Budget Division, U.S. Coast Guard, April 12, 1974. Presumably the trend will improve, but the "undetected spiller" is still a potent threat to the sustaining nature of any Pollution Fund.

51. Judgment against SS *Zoe Colocotroni* occurred more than five years after the spill.

52. See Buglass, L. J., The Big Oil Spill: Potential Liabilities vs. Available Insurance, Twelfth Annual Houston Marine Insurance Seminar, September, 1977.

53. Lipeles, M., Oil: Study of Pollution Insurance Liability Laws, Environmental Policy Institute, 1977, pp 325-329.

54. Id. at pp 329-330.

55. 33 USC Sec. 1321 (p) (1).

56. 33 USC Sec. 1321 (p) (5), (6).

57. 33 USC Sec. 1321 (i) (1). See *Gulf Refining Co. v. United States*, 69 FRD 300 (1976) for possible recovery under Suits in Admiralty Act.

58. See *Burgess v. M/V Tamano*, 564 F.2d 964, (1st Cir. 1977).

59. *Askew v. American Waterways Operators, Inc.*, 411 U.S. 325 (1973).

60. *Ray v. Atlantic Richfield Co.*, _____U. S. _____, 55L. Ed. 2d 179 (1978), holding that federal law preempted state pilotage requirements and tanker design, construction and operating requirements in Washington law void under the Supremacy Clause in U. S. Constitution; *Chevron USA v. Hammond*, 1978 AMC 1697, (D. Alaska 1978) holding "risk charge" in state statute preempted by Title II of the 1972 Ports and Waterways Safety Act, 33 USC Sec. 1221-1227, 46 USC Sec. 391a.

61. *Exxon Corporation, Tanker Safety and Environmental Protection*, January, 1978, p. 9; Menton, O.R., Superfund - The National Oil Spill Liability and Compensation Proposal, Twelfth Annual Houston Marine Insurance Seminar, September, 1977.

O'Neill: I just wanted to point out that as far as California is concerned, we'd be glad to be preempted from a state fund. We have no interest in putting in a per-barrel tax on anyone to cover a fund because there are federal funds available. Our reservation, and our reason for opposing preeemption relates to the damages for which compensation can be recovered. You get into this very fuzzy area of so-called unquantifiable damages; that is, demonstrated damage to the natural environment on which you can't hang a price tag. We had a case with the Oakland estuary spill in 1971 where there were about 200,000 gallons of oil spilled, lots of unquantifiable damage. A fraction of that damage was the killing of wild birds, one species of which happens to be raised on a commercial basis. It was established that it would cost $36,000 to purchase the same number of birds of that species as were killed by the spilled oil. But under California's law at that time, the maximum fine that could be assessed against the spillers was $24,000, so not only were they not hit for the demonstrated cost, they were totally free from the additional costs which you can't put a dollar figure on. We don't know the best way to establish what fair compensation might be for natural resources damaged by oil spills, but federal legislation is pending. The House version would preempt the states and not allow recovery for anything other than income, real property, or the categories you ran through. When the federal

government enacts legislation that would at least give lawyers a chance to try to establish what fair compensation might be for all damages, we wouldn't mind being preempted. The situation being what it is, though, we're not willing to be preempted.

Russell: That's all to be developed, even under the federal scheme now. If you want to see an interesting approach to damages, read the *Zoe Colotocotroni* decision. The judge used the laboratory cost of replacing the microorganisms that were killed, some 92 million, I think. In other words, 92,000 at 'X' cents per organism equals the damaged award. I don't know that its a valid standard and I think it might get tested in the court of appeals.

Unidentified Voice: Do you have a citation for that?

Russell: Yes, 11 ERC 2107. It's in the *Environmental Reporter* Cases. You will find it in the advance sheets of September 22, 1978.

Benkert: On this discharge case in Puerto Rico, I'd like to throw this comment out. That was a very bad case in the sense of deliberate discharge of oil to lighten the vessel enough to get off the beach. Under those circumstances, it's understandable why all the flack came out on this, the dire comments in the newspapers, tirades, and so on. I would simply like to say that there are cases where a vessel goes aground in terrible weather, where there is the danger of a loss of life, and where there is also a danger of a loss of the entire vessel and its cargo of oil coupled with the possible loss of life, where this type of action might be the best thing to do. You've got to look at the cases and the circumstances. The publicity that came out on that thing was, in my mind, another example of newspapers, magazines, and people going berserk when they didn't know what they were talking about. You have to couple each case with some understanding of the sea and what can happen too.

Haimbaugh: Dr. Ernst Frankel was previously introduced when he spoke on tanker demand models. He will now present his paper "New Technology in Shipping Crude Oil and Refined Products".

NEW TECHNOLOGY IN SHIPPING CRUDE OIL AND REFINED PRODUCTS

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ABSTRACT: Recent IMCO Conventions and protocols would go a long way in reducing the potential hazards of operational or casualty spills by tankers, if ratified and properly introduced. The technological improvements, though, are primarily designed to reduce or eliminate the need for ballasting cargo tanks and reduce the potential damage to cargo compartments as a result of collision, grounding, or similar mishaps. In other words, the improvements are concerned primarily with assuring clean ballast emission and protection of the cargo.

This paper reviews the wider range of existing and potential future environmental hazards posed by the tanker transportation system as a whole. Operating and design technology available now and expected to be available in the near term future as a result of technology transfer or new developments is discussed. The implications of the introduction of such new technology are next evaluated from the point of view of future tanker operations and interactions with other components of the oil transport system such as terminal, storage, and traffic control technology.

INTRODUCTION

The objectives of this paper are to review the effect of ecological factors on tanker design and operations, and to summarize the environmental impact assessment and control requirements in tanker technology development and operations. The economic advantages and the need for tanker transportation as well as resulting technological developments are usually readily established. On the other hand, the costs of the potential effects on the environment are often difficult to formulate and quantify and therefore pose potential difficulties for tanker technology development. While many tanker transport induced hazards are real and the possible resulting damage great, others are secondary or imaginary. Ecological concerns more than economic considerations have affected recent tanker design and operational decisions and will continue to do so until an effective balance is found which establishes environmental viability. Ecological factors are therefore now among the major driving forces of technological developments in tanker design and operation.

No attempt will be made to arbitrate between the conflicting viewpoints of the probability, type, effect, extent and permanency of ecological damage caused by or through tanker operation. Instead, we will discuss the ecological factors that must be considered in the design and operation of tankers and the developments of new technology designed to cope with these problems.

Tanker design features and operational procedures may be developed to reduce environmental impacts of tanker transportation. As prevention is infinitely more desirable than reactive containment and clean-up development in oil transport, technology is aimed at prevention. Yet, there will always remain a probability of ecological damage resulting from the unexpected. It is exceedingly difficult to quantify the effects and probability occurrence of these different potential environmental causes, as they depend upon:

1. physical conditions such as currents, water depth, wind, wind and current direction, salinity, waves, solids in suspension, seabed or inlet formation, air/water temperatures, etc;
2. chemical and physical properties as well as form of cargoes handled;
3. environmental conditions;
4. traffic control, congestion, interference, etc;
5. training, competence and reliability of manning;
6. interface technology;
7. operational policies; and
8. regulations.

Most of the above factors are independent and time varying.

The number of tankers in service has remained practically constant during the last 20 years, although the deadweight tonnage (dwt) has increased more than four-fold. The average oceangoing tanker in service has now a deadweight of 94,000 dwt, while the largest tanker has about 573,000 dwt capacity. As in air transportation, where the introduction of jumbo jets has resulted in halting the increase in congestion of the skyways, it is argued that larger ships will prevent the congestion on heavily traveled sealanes from becoming excessive. Unfortunately, while this may be true from a purely statistical point of view of probability of collision and grounding, the magnitude of damage caused in a mishap is that much larger as recent accidents have shown. The ecological impacts of tanker operation fall into:

1. operational impacts:
   voluntary: discharge of ballast, oily water, sewage, solid waste, exhausts, erosion;
   involuntary: collision, grounding, spillage, fire, explosion, gas emission and resulting discharges;
2. interface impacts at onshore and offshore ports and terminals; and
3. interface impacts with onshore and offshore activities such as fishing, offshore mining, offshore petroleum production, recreation, aquaculture.

The range of potential impacts is large, particularly now when the intensity of use of offshore waters increases most rapidly. The number of fixed and floating facilities (exploration or production platforms, service vessels, storage vessels, terminals, etc.) using coastal waters has increased from only about 3800 in 1958 to well over 28,000 in 1978 (over a 7-fold increase). Most of these facilities varying from floating buoy moorings to drilling platforms, are not maneuverable. Similarly, the number of fishing vessels, ferries and service vessels of all sorts using coastal and near ocean waters has increased by a factor of 6 in the last 20 years. Finally the boom in recreational vessels capable of using coastal waters has increased by a factor of 10 in the last 20 years. Coastal waters, in which 98% of all shipping accidents happen, are now used by 9.1 times as many vessels as 20 years ago. Worldwide we now have a coastal water population of over 28,000 fixed or floating non-maneuverable facilities and nearly 4 million vessels and boats (49,000 oceangoing commercial ships, 278,000 oceangoing fishing and service vessels, 4800 oceangoing barges, 340,000 small coastal ships or junks, and finally 2.5 million recreational boats). In other words, coastal waters are getting more crowded at an annual rate of cumulative growth of about 15% per year. Large transport vessels which once dominated coastal waters are now just one of many users. Yet the design and control of coastal approaches has not changed significantly to take this new environment into account. Hand in hand with this proliferation of coastal water activities goes the

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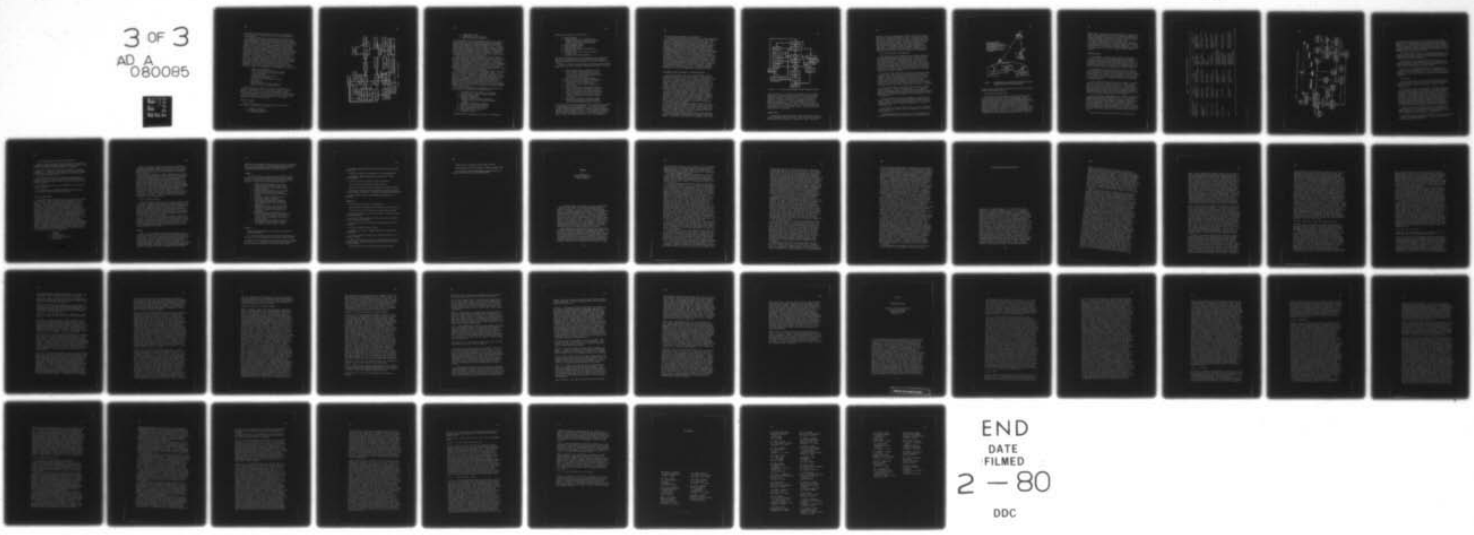

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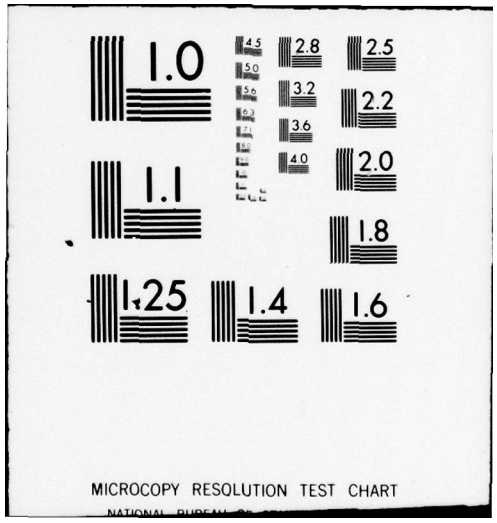
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MICROCOPY RESOLUTION TEST CHART

increasing lack of operating skill, human error, unseaworthiness of craft and related factors which all pose serious problems to safe navigation.

The rapid increase in the average and largest tanker size has caused concern with the impact of larger tank sizes, deeper draft, less maneuverability, longer stopping distances and other operational factors introduced by large tankers. Yet these are only part of the concern. Even if all the proposed improvements in tanker design, manning skill and operational procedures currently under consideration or waiting to be universally ratified were complied with today, many, if not the majority, of accidents would still occur and the actual expected ecological damage would only be slightly reduced. The problem is not only one of improving the ecological safety of design and operation of tankers. No improvement in tanker design legislated or considered could have prevented the *Amoco Cadiz* disaster. The improvements must be directed toward the whole system of use of the seas as transportation use is only one and an increasingly minor component of the use of the seas. True, we need better ship design, improved operating methods and controls, better procedures, more efficient ship machinery and auxiliaries, less dependence on human error or system break down and more. Equally important though, and complementary, are improvements in such areas as:

- ship routing and guidance;
- control of shipping in navigational channels and coastal approaches including coastal traffic controls;
- port/terminal design and interface;
- docking and mooring assist;
- cargo transfer, distribution and storage systems;
- ship automation;
- communications with and among ships; and
- weather forecasting and interpretation.

The above are just a sample of areas where technological developments are necessary, if we are to be able to transport goods safely, economically and in an ecologically acceptable manner. This paper, as a result, will review 'New Technology in Shipping Crude Oil and Refined Products' in its wider aspects and not only in terms of ship technology, with particular reference to technological developments affecting the environment.

TECHNOLOGY PLANNING

Trends in technology were in the past largely influenced by, among others, factors such as (Figure 1):

1. scientific advances;
2. technological assessment;
3. economic incentives;

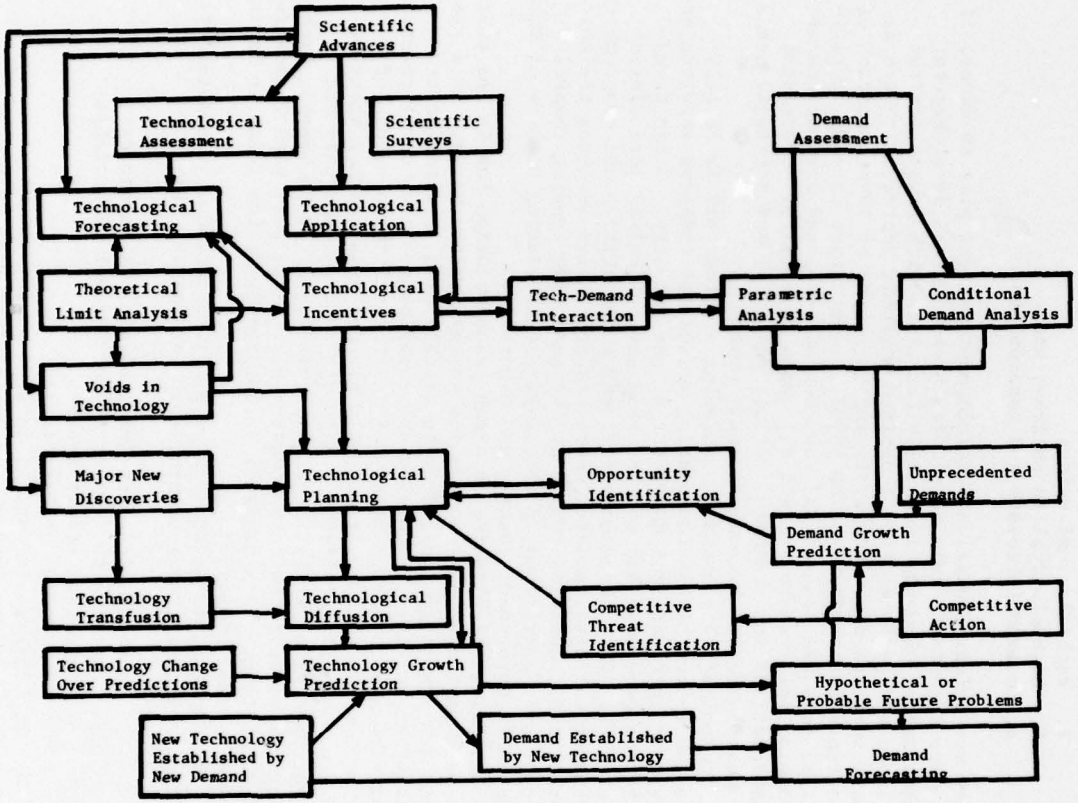


FIGURE 1 TRENDS IN TECHNOLOGY

4. technological voids;
5. technological incentives; and
6. demand forecasts and assessments.

Today ecological, social and development factors play an equal, if not more important, role in guiding technological developments. Technological planning is usually concerned with a more limited horizon, and performed for a defined economic sector. It uses as inputs specific demand analysis and forecasts of identification of opportunities, projections of payoff, competitive threat identification, resource limitation, know-how surveys, and evaluations of technological transfusion and diffusion capability. Overriding considerations are economic, social, political and strategic needs (or goals) ordered by some priority system.

Technological planning in shipping of crude oil is largely affected by the highly fluctuating demand for shipping services and the basic international character of the industry. Ocean transportation generally has sources from one control or jurisdiction to another. This phenomenon influences competitive and complementary technological development. Ocean transportation is among the most competitive industries, while at the same time tending towards monopolistic operations, particularly as increasing numbers of vessels come under government control and ownership.

Technological planning in ocean transportation has in the past not been performed on a continuous and systematic basis. As a result there are now large imbalances in capabilities, capacities and quality of service. Technological developments have until recently been slow and consisted mainly of incremental improvements of past technology. Technology is usually planned using either short or long term planning horizons. Although both the economic and operating life of ships is usually quite long (20-25 years), technological planning in this industry has in the past been fragmented and short term. This may well be the result of the feast or famine cycles in the industry.

The inputs into technological planning include, in addition to system particular requirements, such information as:

1. availability (non-availability) of technology;
2. cost (economics) of use of current technology;
3. interface effectiveness;
4. intermodal integration;
5. changes in capital intensity, investment, distribution, and use of resources, manpower (skill);
6. technology transfusion and diffusion;
7. capability of technology absorption;
8. public image, interest and incentive;
9. safety, reliability, cost factors;
10. environmental factors; and
11. competitive factors.

Various analytical techniques are available for technological

planning and forecasting. These include:

1. mapping methods;
2. network analysis such as relevance tree diagrams decision or conditional networks decision trees graphic network models;
3. systems analysis models;
4. demand assessment models;
5. limit analysis models;
6. changeover point prediction techniques;
7. matrix methods;
8. polling of experts and statistical opinion analysis; and
9. statistical data analysis methods.

The objective identification is usually based on an overall systems measure of performance which must then be analyzed with respect to the resulting performance characteristics of the ocean transportation system.

Objective validation and establishment of alternative technological opportunities as well as subsequent technological planning are affected by:

1. demand assessment analysis results, and cargo flow corrected, where applicable, for the effect of future technological development and resulting economic and operational factors on the demand or cargo flow;
2. influence of external policy decisions;
3. effect of political and military contingencies;
4. interaction with other technical areas and intensity of effort in these areas;
5. effect of private and public investment and involvement;
6. effect of international relations and collaboration on technological developments including such factors as new trade routes, channels;
7. effect of international and national laws, agreements, conventions such as those pertaining to safety, pollution, (oily ballast, sewage, etc.); and
8. significance and effect of interaction among selected prime parameters affecting performance of ocean shipping vehicles in systems.

A large number of methods are available for the construction, analysis, and optimization of the "planning model". The model may consist of a formal mathematical programming model whose structure dictates analysis and optimization techniques. Linear and dynamic programming models are typical examples. In most instances though, the model is far too complex to permit application of one unique solution technique. This is furthermore affected by the use of probabilistic

and/or conditional statements or relationships.

Effective hierarchical structuring and use of subjective matrices, which translate objectives and their relative values into relative outcomes of alternative programs, are useful devices which force explicit statements about the objectives and the programs. The inputs to the planning model or alternative programs are usually in the form of quantifiable engineering and operating performance parameters, which are used to derive resulting values of resource requirements, resource schedule, and level of objective measure. The most important decision in technological forecasting and planning concerns determination of the uncertainties involved in cost, time, development, transfer, application, acceptance, and operational success of new technology. It is for this reason that technological forecasting and planning cannot be performed effectively as a once through study. It requires continuous feedback and updating which provide the inputs for improved estimates of uncertainties. With all the shortcomings inherent in any attempt to plan for the future based on forecasts derived from insufficient data and knowledge, it is increasingly important to use formal technological planning approaches in ocean transportation, not to eliminate inaccurate planning, but to reduce the probability of downright mistakes.

ENVIRONMENTAL IMPACT ASSESSMENT OF SHIPPING TECHNOLOGY

Much has been written about the ecological damage caused by shipping, particularly in the use of tankers in the carriage of crude oil or refined products. Most of these evaluations deal with the impact of isolated incidents (or accidents) or particular operational procedures such as oily water, ballast or waste discharge. It appears to be more appropropriate to assess the environmental impact of oil shipping systems as shown in Figure 2 instead of considering only isolated ships or isolated activities performed by ships. This is important because there are many trade-offs among the different components of a shipping system.

We may, for example, attempt to improve offshore tanker terminals and the tanker/terminal interface in exposed waters. Such offshore terminals would be connected to shore by submarine pipelines. A large percentage of tanker movements in congested and perilous coastal waters could then be prevented. As noted, nearly all (98%) of tanker accidents and incidents happen in coastal waters, and such developments could readily eliminate a major portion of these accidents.

The tanker impact assessments developed in recent years are practically all based on previous accidents. Few, if any, tanker environmental impact assessments have been performed which were not in part instigated by a recent mishap. This is somehow like asking an air safety inspector after an investigation of an air disaster to assess the danger of flying.

Formal environmental assessment procedures exist today which permit a formal step-by-step evaluation of potential hazards and impacts. The problem is generally not of assessment, but of find-

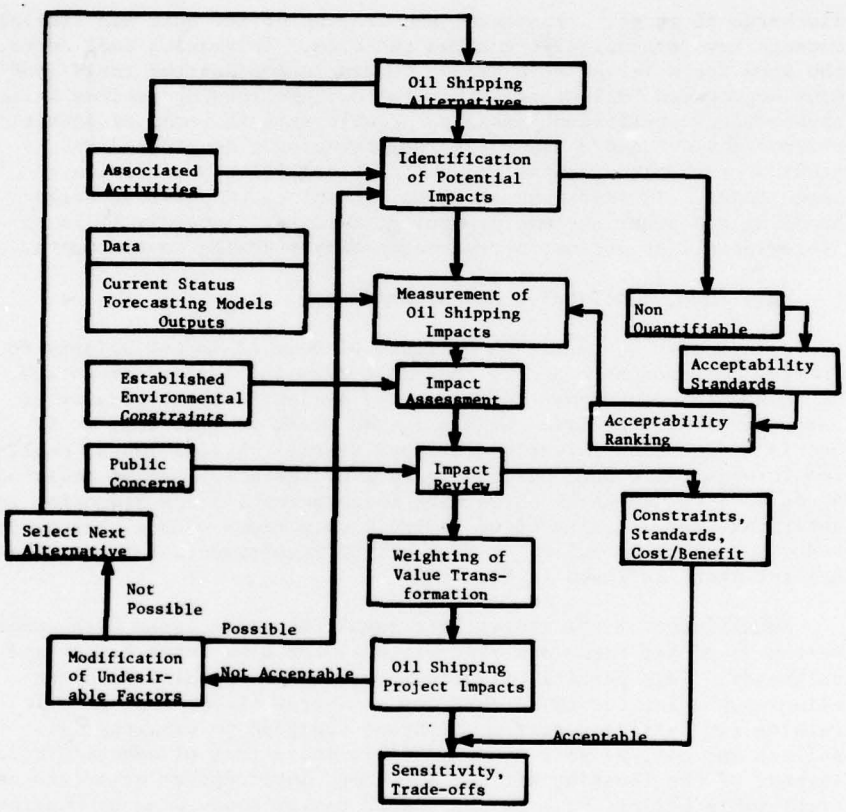


FIGURE 2 OIL SHIPPING ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

ing proper measures or standards to which results can be compared. Unfortunately few reliable standards exist nor do we seem to have reliable and generally acceptable criteria. The most important convention relating to the prevention of 'Marine Pollution from Ships' is the recent IMCO Convention, highlights of which are summarized in Appendix I. It is noted that this, as all other marine environmental regulations, deals largely with the ship and its operations but ignores the regulation of conditions under which ships operate, such as navigational controls, crew qualifications, terminal interface and others.

TANKER DESIGN

Tanker design philosophy has been rather static since the early tanker development about 70 years ago. We have developed increasingly larger ships, but the method of containment of cargo, loading and

discharge of cargo, arrangement and framing of the hull and similar aspects have essentially remained the same. Increasing fuel costs, the need for a larger ship volume to handle the desired cargo load plus segregated ballast and other factors are leading towards fuller, higher block coefficient vessels. Double skin in terms of double bottoms and/or double sidewalls is increasingly considered to provide protection against grounding or collision penetration of cargo tanks. In addition, steering, stopping, propulsion, cargo handling and other systems are being improved. Appendix II is an abbreviated list of some of the major tanker design developments.

Hull Form, Subdivision and Arrangement

Full Bodied Vessels with cylindrical bows of larger volumes for the same deadweight capacity therefore permit a larger percentage of volume to be assigned to segregated ballast without penalty of cargo carrying capacity. Unless loaded draft is critical, or if use is made of the recently developed special shallow depth, small length/beam ratio hull forms, the turn of the bilge can be replaced by an inclined straight shine with which permits large reduction in waterplane for a height of up to 1/5th ship depth with a consequent reduction of up to 30% of ballast weight requirements for the same ballast draft as shown in Figure 3.

Subdivision of the tanker into regulation size tanks with double bottom in center tanks and flat plate center tank inner bottom and bulkheads. This permits effective preparation of walls with non-clinging coating for LOT operations or introduction of a flexible raising and falling separator membrane designed to separate ballast and oil, as well as maintain in walls free of adhering oil. Instead of the floating divider membrane, introduction of a 'dracone' (inflatable ballast tank in the center tanks) could also be considered.

Collision Protection bow and quarter fenders, rotary, pneumatic fenders designed to deflect and dampen impact. Also reduce probability of underwater impact by extending above water periphery. New specially designed elastic structure with shock (energy) absorbing material fill to minimize bow damage and reduce probability of cargo tank penetration.

Steering in addition to steering redundancy, an increase in the rate of rudder turn and improved rudder design, including 'active' rudders to reduce full speed turning radius by 30%. Self adjusting rudder (angle) to achieve a required (programmed) rate of turn or navigational path.

Speed Reduction devices of various sorts are in use or proposed. They consist of fold out-drag surfaces, reversing flow nozzles, and active thrusters.

Integrated Machinery and Steering Control to link propeller resolutions and direction with rudder angle to obtain desired change

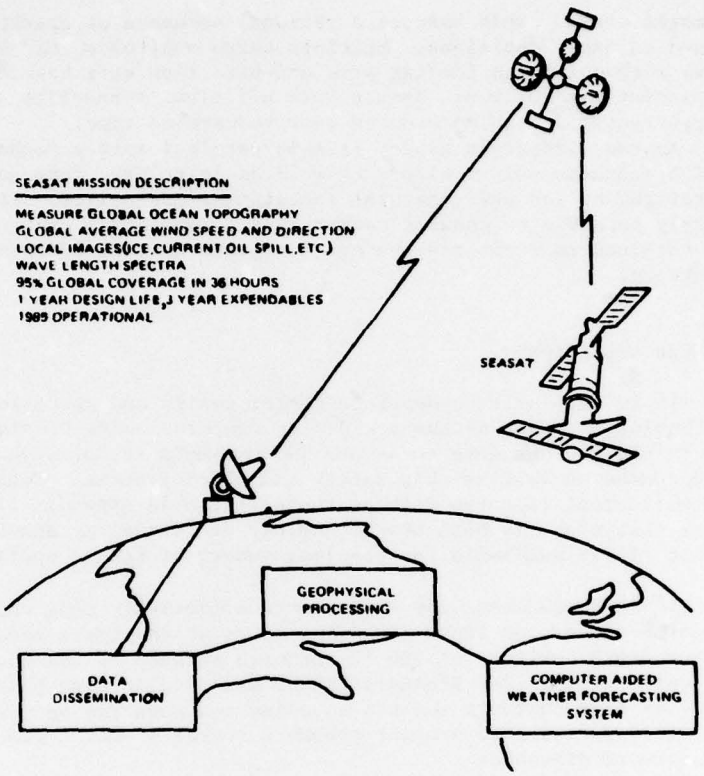


FIGURE 3 ENVIRONMENTAL DATA GATHERING AND PROCESSING SYSTEM THROUGH PROPOSED NASA'S SEASAT CONCEPT

in speed and/or course under given draft, trim, current and weather conditions (programmed control).

Cargo Discharge/Loading Systems

In addition to load indicators and various hydraulic, hydro-electric, electro-electronic cargo control systems, today's technology permits automatic cargo loading/discharge sequencing consistent with receiving, ship trim/stability/strength, ballasting and other requirements. Such systems can be controlled by a microcomputer/processor using canned software which includes a variety of scenarios. In addition, automatic quick shut-off devices are available which shut off supply in an emergency (sudden pressure drop resulting from leaks, etc.) or sudden pressure rise (resulting from valve closure, etc.). These systems can also be programmed for automatic emergency measures such as transfer from

damaged tanks. This assures a rational sequence of operations not based on panic decisions. Multiple cargo manifolds (midship and bow) with shipborne loading arms and effective safe hose handling equipment available are assure more efficient connection of the cargo system including reduced port turnaround time.

Another important aspect is ship-terminal safety technology which connects ship monitors as well as inert gas, form and other firefighting and environmental containment capability. It is similarly possible to connect tanker loading/unloading control systems to terminal controls and thereby integrate overall operational controls.

TANKER OPERATIONS

It is difficult to separate tanker design and operational technology as many of the new design features under consideration or in use are designed to assure improvements in operational procedures as well as ship safety and effectiveness. Considering technological features such as those listed in Appendix III, we note that there is both new technology or technology adapted from other fields available for the improvement of tanker operations.

Depth Measurement can now be more effectively made using bow mounted integrated front scanning sonars which give a reading of water depth contours of 500 ft. or more forward of the bow, dependent on water depth. The scanners can be designed to give both forward and, as side contours and the sounding contours can be integrated by microprocessor to project probable contours over a wider range of forward distances.

Computer Assisted Ship Management Systems integrate navigational controls and controls of ship functions such as engine controls, steering controls, pump transfer controls, etc. In addition or instead, a 'black box' ship function monitor can also be designed using existing technology which monitors all important variables or measurements such as rudder angle, engine setting/direction/rpm, speed through water, exhaust quality, liquid effluent quality, tank conditions (soundings, liquid content, etc.) and more.

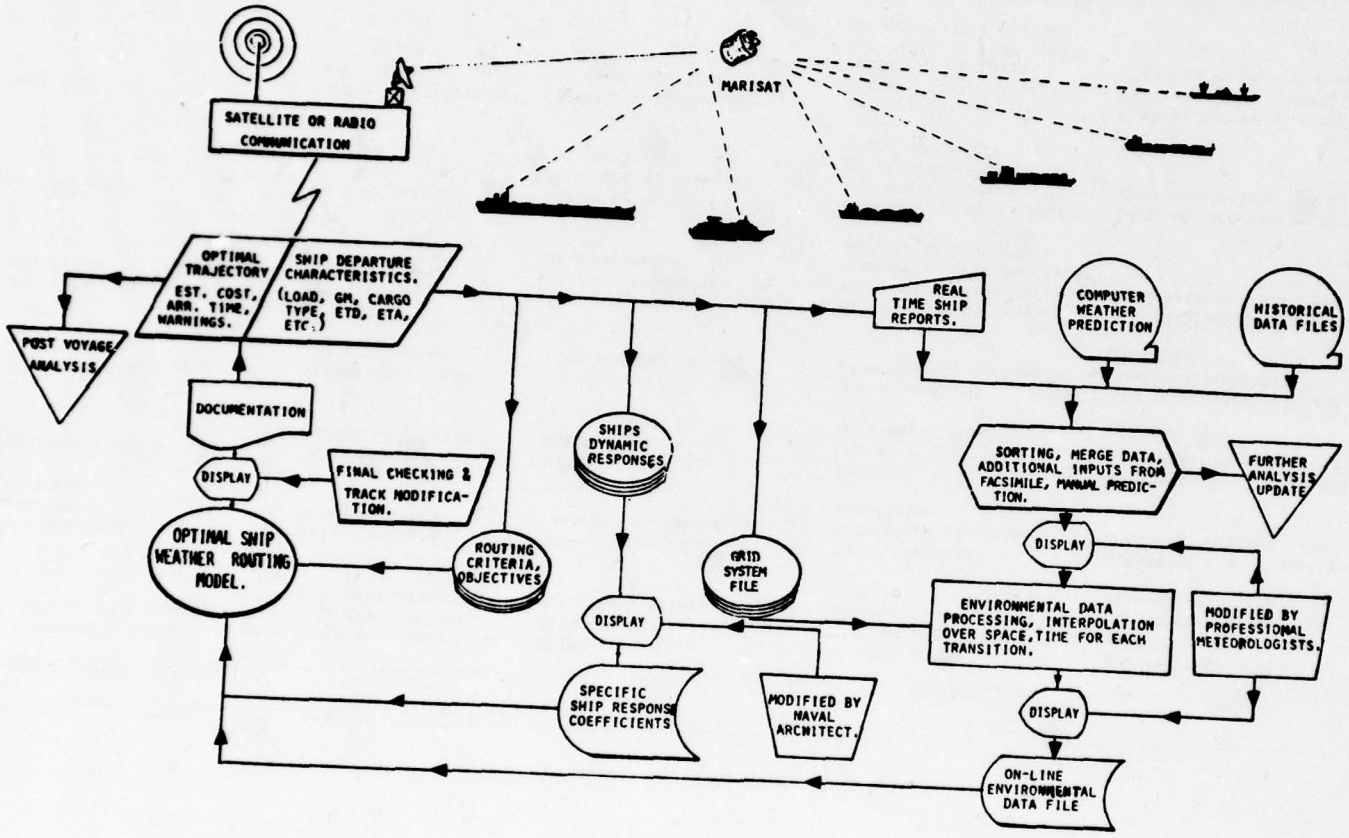
Ship Position Fixing and Routing assist technology using sensing/communication satellites (SEASAT/MARISAT, etc.) and other methods. Optimum ship routing systems (Table I and Figure 4) are available now (under test)) which integrate continuously updated weather and other environmental information for optimum ship routing based on minimum time, least cost, minimum fuel or other criteria. Routing method uses all ship characteristics (see Figure 4) and can include consideration of defined traffic lanes, routing around static or dynamic obstacles, integration into desired traffic pattern and more.

Congestion of traffic lanes, particularly in coastal waters,

TABLE 1. OPTIMUM SHIP ROUTING EVOLUTION CHART

Technology/Time Periods	-1950s-	-1960s-	-1970s-	-1980s-
Environmental data gathering & forecasting	Historical data from ship observations, meterorologists	Ship observations, ocean weather ships, satellite, meterorologists	Weather ships Weather satellites, computer wave prediction	Fully automated data gathering processing, forecasting system via satellites
Date dissemination & communication facilities	Radio, telegram, weather charts	Radio, telegram, Tele, land-based facilities	Radio, Tele/TWX facsimiles via comm. satellites	Extensive use of satellites & better coverage
Navigation facilities	Charts, celestial navigation, LORAN A	LORAN A-C, DECCA, OMEGA, TRANSIT	LORAN C, OMEGA, Nav. satellites	Extensive use of satellites & better coverage
Computer technology	Calculating machine, 1st generation	2nd generation, time sharing systems	3rd generation, time sharing systems	4th generation; cheaper, faster mini-computer technology
Ship motion seakeeping prediction	Experiences, empirical data	2-D Ship motion program, simple seakeeping, statistics	5-D Seakeeping program with added resistance in head seas, more realistic seakeeping criteria	5-D with added resistance in arbitrary seas (6-D)
Routing methods	Graphic, manual	Computer aided heuristics, calculus of variations	Calculus of variations, stochastic dynamic programming (open-loop control)	Adaptive stochastic D-P with closed-loop control
Benefits	Safety, shorter time of crossing	Safety, minimum time of crossing, less cargo damage	Safety, minimum cost, minimum time track, passenger comfort, logistics & other types of objective functions	Same as before plus better Marine traffic control, and efficient port operations

FIGURE 4 PROPOSED SET-UP FOR A REAL-TIME SHIP ROUTING SYSTEM.



is expected to require strict traffic controls to be introduced within 10 years in many parts of the world (Malacca Straits, English Channel, etc.). Automated remotely controlled steering, or semi-automated steering (approach or guidance beam, etc.) are technologies currently available. Collision avoidance systems available now are passive (signal) devices which would readily be converted into active navigational or steering control systems.

Ship Communications By Satellite is becoming increasingly common. Technology for automatic communication contact between vessels expected to pass each other within a certain limited distance can be introduced using existing technology.

Radar Detection is a technology available at little cost. It permits detection or verification of radar use and radar effectiveness by approaching vessels. This would permit imposition of navigation controls on ship without effective radars.

Motion Detection has been perfected so as to permit detection of motions over a few hundred feet. Use of this technology is possible not only for ship security in port or small craft detection underway, but it can also be used for a variety of other monitoring functions.

Ship Docking

Lasar and Sonar assist or controlled automated docking devices have been developed. They can be used to control side thrusters, tugboats, variable tension mooring winches, and other docking assist devices.

Line Handling Methods for safe transfer of mooring lines over longer distances have also been developed. Increasing attention is being given to mooring procedures which allow for line handling from shore and elimination of line handling crew on board. Other developments under investigation aim at elimination of lines altogether. All of these methods attempt to develop mooring systems which are self-adjusting, require no more than one person each (bow and stern) on board, and assure rapid but safe docking and acceptable docking approach speeds. Studies also include the relative advantage of mooring control on ship board versus making the mooring of the ship a terminal mooring master responsibility.

Fenders have received extensive attention. An important new consideration is the use of chains of large floating fenders on both the dockside and outboard side of the moored tanker to provide better retention as well as protection of the vessel.

Ferry Slip Type Booms have been installed in a number of locations to protect waters around the terminal. These are part of both the mooring and containment equipment.

Environmental Control, Prevention and Clean Up

Most of the design and operating technologies mentioned directly or indirectly affect environmental aspects of tanker operation. There are other technologies, though, which should be discussed.

Removable of Collapsible Storage Tanks (deckmounted, portable, launchable, etc.) designed to store slop, oily water, gathered spill or other waste. Such tanks can be designed to be rapidly attached to various ship and other outlets.

Oily Water Separators fed by self-propelled suction skimmers attached to multiple extendable pipelines to permit tanker to clean-up spills within oil retention booms, carried by ship and installed wherever necessary.

Non-Clinging Tanks surfaces on all bulkheads to reduce or eliminate oil adhesion.

High Pressure Ejection Equipment capable of spraying limited spill area with sinking, neutralizing absorbants.

TERMINAL SYSTEM FACTORS

As mentioned before, tankers are only one link in the oil transportation chain. Their effective operation depends, to a large extent, on their design and operational integration with tanker terminals. Tanker depth requirements which are difficult to accomodate at ports not hitherto served by tankers, new offshore oil production developments, coastal management, environmental concern, land use restrictions, and other factors cause more and more tanker terminals to move offshore. While floating single point moorings or similar type moorings served tankers during the last decade and over 300 of these versatile loading/unloading platforms were installed worldwide, future needs demand incorporation of storage and terminal facilities in a self-contained facility. This is expected to lead increasingly to the use of single hull or catamaran type gravity caisson offshore tanker pier facilities. These can be installed as floating or sunken gravity platforms and may become offshore terminals for a submarine pipeline or distribution network. Conversely they could serve as transfer platforms between tanker and pipeline or gathering pipeline (from a number of production platforms) and an exporting tanker. Offshore prefabricated tanker terminals will have the advantage of:

1. low cost;
2. mobility;
3. relocatability;
4. short delivery time; and
5. independence.

Similar platforms are expected to also serve as supports for refineries, petrochemical plants, fertilizer plants, gas liquefaction and storage plants, cement plants, and more. These process plants would combine plant, storage and terminal in one platform mounted facility.

New terminal technology will demand reconsideration of tanker design and operating approaches. Another aspect is the integration of terminal and tanker design to assure greater compatability in all aspects of operations including joint operational and safety control, total tanker/terminal systems monitoring and more. It appears highly advisable to extend regulation to include terminal design and operating requirements. Some terminals have developed effective oily water ballast processing plants. Singapore presents an outstanding example with a 120,000 ton receiving capacity (5000 tons/hour) via a set of SPM anchored in Singapore Harbor. The ports authority makes this service available to both arriving tankers in the product export trade or tankers returning in ballast to Indonesia. The port processes all recovered oil and makes a large profit on its sale. In fact the facility more than paid for itself with a 3-year operating life.

Other Technological Factors

Integrated tug-barge systems play an increasingly important role in coastal oil shipping and are expected to enter transocean service before 1985. Tug-barge systems offer the advantage of separability of the tank compartment; this may on occasion allow reduction of transfer requirements because the floating storage provided by the decoupled tank barge often eliminates the requirement for transfer into intermediate storage tanks. Barges also have a significantly lesser draft than tankers with the same deadweight capacity, a fact which may reduce the risk of grounding.

Other technological factors concern the changing composition of the cargo. In the future an increasing percentage of tanker transportation in ton miles is expected to be in the carriage of product versus the traditional preoccupation with the transport of crude oil as more refineries are built near the production location. This implies larger potential for toxic spills and greater difficulty of spill discovery or monitoring.

SUMMARY

There is a large variety of new technology available to make shipping of crude oil and refined products more effective and safer in the future. Some of this technology is available now while other technology can be readily adapted or developed from applications in other fields. There is an increasing concern with the ability, training, and quality of ships crews as well as terminal staff. An unduly large number of incidents can be traced to human error, failure or simple disregard. While many of the technological improvements available or proposed will assist in making tanker and terminal

operations less dependent on operational decisions by crew of staff, there is an urgent need for better training, continuous upgrading or retraining, development of uniform standards, monitoring of operational decisions and medical testing of personnel.

APPENDIX I

The IMCO Convention on Marine Pollution from Ships includes measures to control more pollutants than ever before--stress is put on prevention rather than clean-up and other post-accident measures. It includes the following salient features:

1. regulates ship discharges of oil, various liquid substances, harmful package goods;
2. controls for the first time tankers carrying refined products;
3. requires segregated ballast for large tankers (but does not require double bottoms);
4. prohibits all oil discharges within 50 miles of land;
5. mandates all tankers to operate with the load-on-top system if capable;
6. reduces maximum permissable discharge for new tankers from 1/15,000 to 1/30,000 of cargo capacity (NOTE: no total discharge prohibition);
7. regulates the carriage of 353 noxious liquid substances with requirements ranging from reception facilities to dilution prior to discharge;
8. prohibits discharge of sewage within four miles of land unless the ship has an approved treatment plant in operation, and from 4 to 12 miles unless the sewage is macerated and disinfected; and
9. prohibits disposal of all plastic garbage and sets specific minimum distance from land for disposing of other kinds of garbage.

APPENDIX II

Tanker Design Developments Directed Towards or Impacted by Pollution Prevention

Full Bodied Vessels with larger displacement/deadweight ratios and therefore larger segregated ballast capacity (draft constant).

Deeper Hull Form with greatly reduced waterplane area for height above keel of up to 1/5th ship depth and resulting improvement in ballasted draft and reduction of lost double bottom volume.

Double Skin segregated double bottom, wing tanks, bow wing tanks, sponson tank.

Subdivision regulation of maximum size of cargo compartments.

Steerability larger steering planes, greater rate of turn, active rudders.

Collision Protection structural internal, fendering.

Speed Reduction short distance stopping devices.

Machinery and Steering Control integrated with automated linkage.

Automated Ship Management Systems prevention of wrong operation or wrong sequence of operation. (Override is automatically documented).

Cargo Discharge/Loading Systems shipborne loading arms, bow manifolds.

APPENDIX III

Ship Operating Procedures and Instrumentation

Depth Measurement bow mounted side scanning sonar depth recorders.

Computer Assist Loading unloading rim and stability planning.

Automated Overflow and cross flow prevention. Automated loading/unloading sequencing.

Traffic Control ship rounting, traffic land control, shorebased traffic centrals--routing lanes.

Collision Prevention active/passive anticollision devices and procedures.

Navigational assist, position, fixing.

Communications Satellite communication system, intraship communications.

Oily Water Separation holding tanks, discharge procedures, oil separation devices.

Docking Assist Technology optic or acoustic docking sensors and control devices. Automated docking, devices, mechanical or hydroelectric linkage.

Computer Controlled Cargo Handling sequencing and control.

Shipborne Spill Containment System skimmer clean-up.

Portable Hydraulic Deep Well Pumps for emptying damaged tanks.

Use of Sinkable Flexible Membranes to separate ballast and cargo as well as contain cargo in damaged tanks.

REMARKS

F. L. Wiswall, Jr.
Liberian Services, Inc.
Reston, Virginia

Mr. Chairman, Ladies and Gentlemen, my name is Frank Wiswall. I jumped off the bridge of a ferry boat some years ago and landed in law school. In 1974, I became the Chief Operating Officer of an American company which, under a contract assignment, provides professional administrative services to the Liberian maritime program. Although a lawyer, a major part of my work has been in the area of Marine Safety, and I have been involved in some way in every Board of Investigation of every Liberian tanker casualty since the *Torrey Canyon*. I have been a maritime legal advisor to the Republic of Liberia for ten years, I am in my fifth year as the Vice-Chairman of the Legal Committee of IMCO, and at this moment am Acting Chairman of the Committee. It has been suggested more than once that I should go back to being a ferry boat captain--and life certainly would be more placid.

Because organizations were mentioned yesterday in connection with the formulation of international maritime conventions, I want, on behalf of the Legal Committee, to acknowledge the special contribution made by the Comite Maritime Internationale. The CMI is the international parent of all of the national maritime law associations, and from its founding in 1896 until the formation of the IMCO Legal Committee, the CMI drafted and then organized the conferences which concluded the entire series of Brussels' Conventions on Maritime Law, including the 1910 Convention on Assis-

tance and Salvage, which has direct relevance to the topics under discussion here. For the past ten years the CMI has been represented at meetings of the Legal Committee as an NGO, and has meanwhile provided the Committee with suggested draft instruments in the private international law area.

The question whether regulation is effective is not the same as the question whether regulation is beneficial to the ends sought. Both the Tanker Safety and Pollution Prevention (TSPP) and Standards of Training and Watchkeeping (STW) instruments are likely to be beneficial eventually; the question is really one of time and degree.

It was the conventional wisdom of the 1950's and early 60's that the substandard ship (as it is now called) was responsible for the vast majority of marine casualties; it is the received wisdom of the present day that the "substandard mariner" is the cause of the vast majority of casualties. The truth must lie somewhere between these extremes. Much has been written and much attention devoted to defining the substandard ship, but there is no agreed definition of the substandard mariner. The latter may, for example, be any seafarer aboard a flag of convenience ship in the eyes of the ITF (unless he sails under an ITF license or "blue card") or one who, in the eyes of the regulatory agencies of the developed nations, lacks a formal and technical education to evidence his qualification. What we must recognize as a fact is that the vast majority of merchant seamen, and particularly officers, are both serving at less than ITF wages and do not have a "thorough" academic education, but may yet be fairly said to be basically qualified for their service by practical education and experience. The problem is that they are "rusty"--they have not had to exercise in practice the knowledge which they had to acquire in order to obtain their license or certificate, and there is no requirement of law or of the operating company that they maintain these skills. The most notable example of this is inefficiency in the use of basic navigational instruments, particularly radar, and in the use of emergency techniques in the engine room.

STW is intended to provide the industry with a "new generation" of better educated officers. But the lead time for STW to become fully effective by ratifications, implementation and the production of the first generation is probably at least eight years. What, then, is the effect of the new regulations going to be between now and the latter 1980's?

To answer this, I take as a basic premise that the TSPP provisions will, within this space of time, become to a degree effective in the major oil-importing countries making it unlikely that the United States, for one, will be served by a wholly dedicated fleet (although this will happen if measures in excess of TSPP requirements are unilaterally imposed). This leaves the matter of the impact of STW, and here I would offer you two alternative scenarios.

The first is based upon the expectation that present conditions in the tanker market will prevail into the early 1980's. If so, the supply of reasonably experienced and basically educated officers and crews is likely to be able to keep pace with the demand, with

certain lags from place to place and time to time. This would give an opportunity to all concerned to effect a "crash" program of retraining and reeducation for serving mariners, at sea and on shore--and it is this type of program, rather than regulation, which offers the *only* real hope of improvement in the immediate future. The oil companies have been doing this for some years, and the major independent owners have begun such programs. We should encourage their expansion, and concurrently work for the removal of such obstacles as the refusal of the United States to permit foreign deck officers and watch standers to become certified radar observers through attendance at the radar schools operated by the Maritime Administration. This naturally involves a strengthening of the will of governments to proceed in the face of opposition from vested interests who wish to reserve the seafaring labor market to themselves exclusively. So we are presented with an instance (and not the only one) where an actual deregulation will be of more benefit to the agreed goal than increased regulation.

All other things being equal, it is obviously the smaller independent owner who will encounter more difficulties in implementing a retraining and reeducation program. This simple economic fact makes it essential that governments and international agencies act together to establish more of the sophisticated training centers which include radar simulators and shipboard disaster simulators, and particularly that the developed nations assist in locating some of these new facilities in areas of the world where mariners of the developing nations can have relatively free and easy access to them. "Me first" has no place in rational consideration of this problem; what good will that philosophy do the well-found vessel and well-trained crew of a developed country which has come into collision with the vessel and crew of an underdeveloped country which has not had access to retraining and reeducation? Such a situation would be stupifying economically, as well as bad public policy.

The alternative scenario is based upon a hypothetical sudden boom in the tanker market. It is not usually appreciated in the United States that there is a worldwide shortage of officers and crews, and that in the present *depressed* market the supply only barely keeps pace with the demand. As an example of the seriousness of the situation, we are seeing Greek owners and operators shifting for the first time in history to non-Greek owners and operators ratings level. These crew members are fully covered by the Greek union benefit agreement and are paid at the level of Greek nationals; their use derives purely from the shortage of Greek nationals willing to engage in maritime service. Less surprising but equally meaningful parallel developments have occurred in the crewing patterns of certain Japanese and Hong Kong owners.

A boom or even a mini-boom in the tanker market is going to mean that shipowners will have to recruit what they can find for crew, and at drastically increased costs. Practical experience will be at a premium, but "paper" qualification will have to suffice. Economic pressures will be especially heavy if a tanker market boom

occurs before there has been some real improvement in the economies of the developing countries that now supply large numbers of seafarers as foreign-flag vessel crew. It is extraordinarily difficult for us to appreciate what this foreign exchange source and employment market means to these developing countries, but one indication appears in the fact that an ordinary seaman paid at accepted rates in the Philippines earns more than a successful trial lawyer in Manila. It is already the perception of the developing countries that the ITF movement is an organized discrimination by the labor capitalists of the developed countries against the development of a viable labor market in the Third World. Also involved is the realization of the developing countries that their economies could not tolerate the distortion which would result from the acceptance of ITF rates by this one section of the labor force. Obviously, the developing countries are not going to tolerate a regulatory restraint in a booming market which has the effect of suppressing employment of their seafaring nationals in favor of employment at vastly higher rates of the nationals of the developed countries.

In a booming market, the flag of convenience authorities and vessel operators are likely to undergo the least change in employment and qualification patterns. Flag of convenience owners well know that they will be the first to come under examination and they are ill-equipped to evade regulation of crew competency, which, with other international requirements, is being increasingly controlled by the convenience flag states as well as the port states to whom they trade. The more interesting distinct possibility is that certain so-called "traditional flags" which have already taken on some or most of the major characteristics formally ascribed to "convenience flags" will utilize their stronger political positions to resist and evade, at least to some degree, the imposition of crew upgrading regulations by other developed states.

One must bear in mind that while a verification inspection under the provisions of SOLAS may result in a thorough safety inspection by the port state where the evident conditions vary from the statements in the safety certificates, the only evident variance from the statement of a Certificate of Competency issued to a mariner is the one which occurs when a casualty happens. There is an ingrained disposition on the part of the regulatory authorities of developed countries to look with suspicion upon the licenses of convenience and developing flag countries, and a general acceptance of the licenses of "traditional" maritime countries (in large part based upon actual experience prior to the mid-1970's). The competence of unlicensed crews aboard "traditional" flag vessels is presumed, whereas it is not presumed aboard others. Furthermore, the real weight given to a diplomatic protest received from a developed country is far greater in matters dealing with the internal economy of vessels. A possible result from all these market pressures may be that the degree of successful resistance and evasion of regulation by some developed maritime countries will increase.

These scenarios are not mutually exclusive. My guess is that we will continue to see development in the features of both.

PANEL PRESENTATIONS AND DISCUSSION

Bardelmeier: I'm Bill Bardelmeier. I'm with the firm Jones, Bardelmeier and Company of Nassau Powers. We are a highly specialized ocean shipping consulting company. We are retained by a number of governments on matters involving bulk shipping, largely oriented toward the economics of ocean transportation. I have been particularly impressed here to find that a number of us here in the group have mentioned the "people" part of our safety problem in tankers more and more. Much of the formal agenda dwelt upon the "hardware" part that has been well-tackled at the IMCO level... and we've heard about the success made in that area, but I do have some observations. In this session I want to bring up the extent to which I think we in the shipping industry ought to look more at the "people" problems because I think in many ways they're going to get worse. You are all probably aware that the lay view at least, I think a true view, was that the flag of convenience fleet or flag of necessity fleet, if you will, around the world tended to be American controlled in the earlier stages. In the 50's and 60's the great tendency was, despite what ITWF and others may say, to build magnificent ships and to crew them with the fine seafarers of traditional European seafaring nations. But what I sense is happening now poses a real, world-wide safety problem. Affluence has spread in Europe to the point where crews of the traditional countries are becoming too expensive to man their own national

ships. The current 1978 cost, for example, of a seaman on a Belgian flag *Pana Max* size ship today is $42,000 a man-year (dividing the payroll by the men aboard). That's higher than American flag costs by a little bit I think. This is also true in Holland; and it is true in Norway and Germany. We see numerous European ship owners suddenly moving their ships into Singapore and Cyprus and other foreign registries in order to employ more nationals from emerging nations with lesser skill levels. I really think that while we've had American-controlled "flag of convenience" ships with fine crews in the past, we're going to have to be sure that we don't end up with less skilled crews in the next ten years as new people start to operate ships for other countries. I think it's going to be a world-wide problem because we have a whole new source of manpower.

Many of the resolutions you've talked about here today tend to be what in aviation terms would be an IFR solution, segregated traffic lanes and so on. I have no argument with this. What appalls me is the extent to which the shipping industry overlooks some *"VFR"* solutions that have been with them all the time. A principal precept of VFR aviation is to see and be seen; yet, think how many haze grey tankers are on the seas around the world today. Nobody makes a very serious effort to see and be seen. I think a lot could be done with little things like this that would enhance on-board safety. Stemming from Professor Frankel's observations, if one thinks back only a few years, look how slowly we've increased pilot house visibility. I know MARAD spent some money on it in recent years, but if you go back a few years, no one gave a thought to having anything more than some little round clear view or little, view out the back. Certainly today it's improved, but I think things of this type could do a lot more in increasing the ability to see and be seen. Let me shift gears a bit from the technical problems on shipboard. It may seem a little unrelated to what was said this morning, but I think as Americans, you should all have an interest in it because you still have at least a ten million barrel a day import requirement. Although yesterday's arguments or papers indicated a leveling, hopefully downward trend, you're still going to have a lot of oil coming in. As I have been involved in shipping consulting work and the economics of shipping, I do have a feeling that in the last few years this country has been lulled by the five-year world-wide tanker depression. A lot of people have come to accept this as a permanent state. Some of the "heat" has been off some of the things that demanded solutions a few years ago. What I'm particularly alluding to here is that with depressed tanker rates, it hasn't particularly mattered how deep our ports have been for five years; the difference in cost between a 70,000 and a 225,000 ton tanker in a market such as we've had isn't very great. What has been happening that I'm very conscious of, because I get daily reports of every ship contract let in Tokyo, is that there aren't many being built. We've had a rippling effect from the tanker depression that has depressed ship prices to the point where shipyards have been profitless for several

years. They're "spinning their wheels" trying to stay in business. The cost of building ships in some of the major ship building nations like Japan has been skyrocketing. Japanese labor costs are way up and some day the "catch-up" price is going to have to be paid. If we don't watch it, we can pay a real penalty as part of this "catch-up". My firm has run some figures on what we think the price of new buildings will be in the early and mid 1980's and it can almost stand your hair on end assuming any sort of balance to the market. There are those who say we're going to be back in balance; we don't think it will come for a few years, but it will come. When it does, we think the price of ships is going right out of sight, and this is going to cause some rippling effects in the cost of hauling oil. I feel that America has lost some of the urgent sense of need for the deep water tanker ports. In 1971 and 1972, we all recognized the need and although we have moved ahead, I think the emphasis is off. We've got to be careful. This country needs more than a place to bring in oil in the future in economic size ships, particularly if the ship economics go where I think they're going by the middle to late 1980's. The differential between big ships and little ships will be horrendous then.

Kiss: I have a couple of comments on the presentations this morning by Mr. Steele and by Dr. Frankel. I just want to confirm some of the things that Admiral Steele had said and also elaborate on a couple of the others. He mentioned radars. All of the 267 U. S. flag tankers presently have two radars on board. He was absolutely correct when he said that some of the U. S. manufactured radars that have gone on board these ships have been atrocious. We think there are better ones in the U. S. market now. With regard to collision avoidance systems, the Maritime Administration, from which I come, has been requiring collision avoidance systems on its subsidized tankers since 1972. But again, I'd like to stress that it doesn't help if it is not used. On the steering, he had mentioned that there may be some large costs that have not been quantified. That may be right, but we tried to take an overall look at the impact of the steering requirements in TSPP at MARAD. I'd just like to read you a couple of paragraphs from our study. I want to point out also that whereas I just patted MARAD on the back with regard to collision avoidance radars, we're not always fighting rear guard actions.

In 1964, the Coast Guard upgraded their steering gear requirements, and because of that, modifications to meet the 1978 TSPP protocols aren't going to be required on most American tankers. On the ones that do require some modification to meet the regulations, it's going to be in two areas and that's the addition of a visible and audible steering control power failure alarm. Also on some few tankers that predate 1964, which have a telemotor system, not equipped with an auto pilot, the retro-fit of a second means of steering control will be required. The alarm costs are estimated to be about $5,000 a ship and that is going to affect about 166 ships. The second steering control is going to be in the range of $25,000 and that will only affect about 10 vessels. One point I'd

like to make that I think is perhaps a deficiency in the protocols with regard to steering, is that if the steering changes are so important, and I think they are, they are not being required--applied mandatorily--on other than tankers above 10,000 gross tons. One of the big accidents we had a few years back was the steering casualty in N. Y. harbor where a container ship lost steering and hit a tanker. I'm not saying these requirements would prevent that kind of accident but we haven't addressed the whole problem when we've just looked at the steering on tankers. The total cost of all these features for the U. S. portion of the fleet, the inert gas systems, crude oil washing, second radars and improved steerings, by our estimate was about $224 million dollars, and that doesn't count out-of-service time increased operating costs, and new ships which may be built because of the ineconomics of complicated retro-fit. I also wanted to make a comment about one of Professor Frankel's remarks about the black box. I'm not sure that's really the solution. This is a personal bias I have; I sometimes get annoyed when Aerospace industries think that they can solve all of the Marine problems. I point out that we had a tragic airline collision in San Diego not too long ago, and as far as I can tell, aircraft do not use something like a collision avoidance alarm. They have their traffic control, they are in communication, but that can break down. Perhaps if that aircraft had had some kind of a signaling device to say it's *this* private aircraft, not *that* one, that you're on a collision course with, it could have taken a different kind of evasive action. Again, regarding the black box, we do have, at least on the U. S. ships, something called a bell logger that does some automatic recording of actions or commands that are given from the bridge to the engine room. That's required by Coast Guard, NVIC (Navigation Vessels Inpsection Circular) 1-69 for ships that have some degree of automation. I think I'll stop there.

Haimbaugh: Thank you, Mr. Kiss. Mr. Vander Lans, please.

Leo Vander Lans: I'm Leo Vander Lans, with the California-based law firm of Graham and James. We started as a maritime firm in San Francisco and we now have offices in Los Angeles, Long Beach, Anchorage, London, and Kuwait. I spend most of my time in Long Beach where we spend almost full time on maritime matters.

I think most people here are familiar with the fact that there are many classification societies. We have one in the United States. They exist in England, Japan, Germany, Scaninavia, and France, and they aren't the same. My contact with them suggests that one in particular seems to be quite lax. So if we're looking at enforcement, if I were an owner with problems, I think I would go in that particular direction, and I suspect it's been happening in the industry. There are other things, though that turn off P and I Clubs. We could run through the same countries. I don't think France has one, but in addition to the four or five in England, there is one in the U. S., one in Japan and one in Scandinavia. P and I Clubs are insurers, but they are not the same as in automobile coverage. You don't get a policy; you get a rule

book. Frequently people don't look at the rule book until the casualty occurs. The clubs are sort of gentlemens' organizations; they shake hands and say you have coverage. But there is some very unusual language in some of their rule books. There is language in the coverage of one of the Scandinavian Clubs which says in substance that if the owner knew what the problem was, the coverage is off. That could put an owner on the spot if someone were trying to break limitation. They run the risk of dragging the ship owner right out of his coverage which could be a very serious problem as the owner may not be able to respond.

I was in London a few weeks ago, and this is unrelated, but I wanted to make the remark because I've heard a couple of comments here about foreign seamen. When I was there I was in a group and the subject of South Korea came up. There were men there from China, Japan, England, Germany, and other European countries, as well as the United States. All of them said that the South Korean seamen and South Korean shipyards were very good; that's not the impression I got here, and I don't know whether I was misinformed, but I pass that to you because that was a fairly fresh impression.

I'm in California and I'm supposed to know what you're (Trevor O'Neill) doing. But I would like to join with the Admiral in asking the state of California to go slowly and to look thoroughly before enforcing lawsuits because, while I make my living out of those, I think that's the last resort. If the states would press on, I don't suggest this is happening, to see how far they could go before somebody said, "No, that's federal territory," there will be litigation for years over these issues and we'll never find out whether there is enforcement. On the other hand, Mike and Sid, I think while you've discharged and are discharging your responsibilities, the state and others, consumers if you will, will want to see if the Coast Guard will continue to discharge the duties which they think it has. We've heard things that I wonder about, too. Ernie Altekruse last night asked a question that nobody officially answered: What about physicals? If I am correct, it is my understanding that there is no requirement for physicals in the U. S. Merchant Marine.

M. Benkert: You are not correct.

Vander Lans: Oh. The owners that I've represented don't have requirements and I'm not aware that there are any.

Benkert: There are federal requirements for physical examinations for certain personnel. For licensed personnel and certain other personnel, there are physical standards. There is also a renewal requirement which, admittedly, is very limited for licensed personnel. There is also a limited requirement for able seamen aboard a vessel and for a few GMED's. A number of years ago, the Coast Guard tried a federal regulatory scheme--a full fledged federal requirement for physical examinations on a continuing basis for merchant seamen. At that time it was politically unpalatable and everytime it was brought up it was "No go." We had wide opposition

from labor unions and from some vessel owners at that time. The Coast Guard is now working toward the end that you suggest.

Vander Lans: Also, I recognize that that is a United States situation and we're dealing in this area with mainly foreign carriers which may or may not have a requirement.

Lynch: We are told we have a requirement for an annual physical examination. It's very strict with our Masters beyond age 55. We get into such areas as depth perception, three-dimension, the eye examination--the whole thing. This applies to our Italian seamen as well as our American seamen.

Vander Lans: That's very good to know. I represent some owners who have no policy and others who have one, but not as strict as yours.

Bardelmeier: Yesterday I may have created the impression that I had a poor view of Far East seamen. On the contrary, I was the first one in the American scene to negotiate a contract with a major Japanese seamen union back in 1960 to man our ships. They're probably about the best in the world. But I distinguish between people from here and people from elsewhere. What I really was deploring is the guy who sends a telex to a crewing agent in Manila and says, "Send me some bodies". You know, this happens.

Unidentified Voice: Early this morning Mike Benkert was discussing the means by which a seafarer perhaps could unload cargo to save a ship. There is a tradition which the Maritime industry is losing very rapidly, if indeed it ever had that is the image of limited lifeboats occupied by the women, while the troops went down standing at arms. I think perhaps in part it's the caliber of the seamen and in part it's the value ascribed to the cargo and the traditions involved. I do believe there is some room for instilling the love of the sea among those who use the sea and for looking at the ship as the responsibility in their lives which can't be ignored in the face of death.

Vander Lans: One last point--yesterday I heard items which reminded me of the fact that most of the major casualties that I have either become familiar with or had some part in after they happened, involved among other things, ships' defects. As I said to Sid and to Mike, I assume that the Coast Guard is doing something about it. I'm sure they will under their power with the new law to enact regulations. Something that struck me as possibly being worth pursuing would be a contact procedure at the 200 mile mark, where the fisheries start, to see if the ships have operating radar, fathometer, and the rest of the equipment to decide whether you want that ship to come in. One reason for picking a substantial distance is that it seems in some of the major casualties, the ship owners' representatives didn't even know where they were, so within 200 miles should be safe enough. It would be nice if we just had

to isolate the defective vessels; unfortunately, that's not the case. The *Torrey Canyon* was on its maiden voyage, manned apparently by competent crew and a good vessel not withstanding, it ran aground. A collision case, in Southern California which again proves that it isn't always a defective ship, was between a *new* passenger liner and an aircraft carrier which had two radars on the ship. Everything was running fine and they collided. Fortunately, no one was hurt, but there was substantial damage.

Stanley: I'd like to talk for moment about size and, in conjunction with Professor Frankel's comments on source areas, about reduced lengths of haul and the future for tank ships. I wonder if we really have an appreciation of how big some of these ultra-large vessels have become. Note too that the ultra-large vessels really have a better safety record than the smaller ones. Look at the photograph at the top of your brochure. The gentleman who owns that company has been toying with negotiating for a vessel of 750,000 tons, a size which boggles the imagination. There already is a 573,000 toner at sea. To give you some idea of what magnitudes are involved, envision, if you would, a WW II class submarine carrying 12 torpedoes and sailing off Cape Verde, West Africa in one 24-hour period, this lone tonnage submarine could sink more tonnage than the entire German underseas fleet sank in WW II or could sink very close to the total tonnage that was lost by the Japanese Navy and Merchant Marine combined in WW II. The size of the monsters is indeed remarkable. Why so large? It is for economic reasons pure and simple. It's much more desirable for the owner, for the consumer, for all, I suppose, if you can create economics of scale. Ironically enough, the existing trade routes do not bring these large vessels to our shores. The closest destinations are in the West Indies and the Canadian Maritime Provinces. I think it would behoove us if we did view the deep water port as a real goal.

Steele: First a word of clarification on physicals. I wasn't satisfied with the physicals that were being conducted, so I added on my own requirement. The physicals are there. Unions are responsible for them in our U. S. flag vessels. I would like to take issue with Mr. Russell a little bit on the extent to which liability or criminal sanctions or whatever can be taken against people who go to sea. If you take a man who is going to go to sea to run one of these ships and take great risk anyway, and you say to him, "Look, you foul up, and I'm going to put you in jail, I'm going to take your house and your kids' education and everything like that," I think you're going to have trouble getting him. It isn't necessarily a criminal act on the man's part; in fact, I would think you would have trouble identifying a clearly willful case--the guy pumped it out just to do damage like a vandal. It's very difficult to find a case like that. Usually, you find that it is inadvertance, carelessness, or negligence. I'm suggesting there is a limit to which you can go in the punitive way against an individual to prevent this. Usually, in business, what you do is take out insurance for an executive's errors and you protect him in some

way, and I think that that would happen. The insurance premiums that the company paid for its personnel would go up to satisfy the increased liability, but where you move into the criminal liability, you're going to put the guy in jail for his willful wrongdoing, I think you're chasing the will o' the wisp.

Haimbaugh: Thank you. Mr. Russell, please.

Russell: Perhaps I should start with the Admiral's observation which I completely endorse. The criminal sanctions, though, that are set forth in Section 311, are for the failure to report the spill, not for the spill itself. I think that the undetected spiller, confronted with a significant time in jail, would have a little more difficult decision to make as to whether he is going to try to get away with not reporting the spill. If you couple that with the sophisticated detection equipment that we have so that we can identify the vessel and the master, who may shift it to the chief officer or the chief engineer, I think we would shake the non-reporters out of the trees in a hurry. I don't believe it's the will o' the wisp; I believe the criminal sanctions are a club that is sorely needed. Insofar as the civil penalties go, that is a matter in which the broadest of discretion should be left with the individual case. I have just a comment or two on what Mr. Vander Lans said about arrival notices of condition reports. It's an intriguing idea and I hope it gets followed through for this reason: under the current limitation of liability statutes, the last thing that an owner wants to know, "in a legal defense sense, is the specifics of a problem at sea. Once he gets "privity and knowledge", he's got to make some decisions. Shipowners are better off in the mountain cabin than on the firing line when it comes to limitation of liability. So I would like to see the casualty reports that are used in the MSC ships used for all vessels inbound. I think, to a certain extent, that may already be in the mill. And I think that we should be insistent that the owners be advised, as well as the port authorities in the port to which the vessel is inbound, of any operating problems. A final thought that came up yesterday goes to the entire problem of abating a massive spill. I think that Mr. O'Neill said that he had audited the salvage facilities off the coast of California to see what was available. Two casualties come to my mind: the tankers *Venpet* and *Venoil* collided off South Africa on a December day last year. Both crews were of Chinese origin. I guess the masters wanted to let the crews, who knew each other, exchange Christmas pleasantries. In any event the ships managed to come together in clear weather off the coast of South Africa. Both vessels were evacuated and a significant pollution incident occurred. A South African drilling company used work boats to keep the vessels off the beach long enough for a seagoing tug to arrive and complete the transaction. The significance of that is that on Monday in London, a Lloyd's salvage arbitration over the salvage effort will take place. The other spill incident that couples with that is the *Amoco Cadiz*. If I understand the facts, the owners and the salvage interests that

are available in the English Channel were in communication for some eight hours before the grounding and spill. The *Amoco Cadiz*, unable to cope for herself, drifted slowly down on to the coast. The "no cure, no pay" open Lloyd's Salvage Contract may have to be modified so that, with the massive sizes of the tankers and the massive effort involved in abating the spill from a massive tanker, there will be an interest on behalf of the available rescue craft to participate on other than "no cure, no pay". Part of any salvage award should, it seems to me, include consideration for the amount of pollution that was prevented during the salvage effort.

Haimbaugh: Thank you, Mr. Russell. Professor Frankel.

Frankel: I do not propose that black boxes will prevent any mid-air collision or, for that matter, collisions of ships in daylight in the middle of the Mississippi. But they do provide, particularly in combination with the ship management system. Recording of all major ship function decisions, including steering orders on a permanent time basis. Today we have technology to implement them for minimal costs, and I really see no reason why the black box cannot be introduced. With regard to ship management systems, these provide for operators on board to make effective and correct decisions under complex conditions. They must be provided with the type of help because ship systems are becoming too complex for the type of people we are able to attract to man these ships. Even with continual upgrading, they still need help and I think this help can be provided today. But most importantly, I believe, is that we cannot look at ships as individual units managed by a captain who runs it and whose owner attempts to sit in a mountain cabin, as Mr. Russell so aptly said, and would prefer not to know very much about it. I think we really have to control ships underway, on a real time basis. It is done by the airlines; it is increasingly done by other modes of transportation. We again, have both active and passive systems. We talked before about radar liability. Today we have comparatively inexpensive methods to detect if a radar is operative on a ship as far as 25 miles away. There is instrumentation. We can control radar activity. We can request ships approaching our coasts to prove that they have active and effective radar, and I don't think that the cost of installing this type of control is out of place considering the cost of meeting IMCO requirements and so on. I think you'll find that many of the kinds of things that I mentioned are comparatively inexpensive.

Unidentified Voice: There are controlled routes now. The North Sea, Hamburg, the Rotterdam is controlled up on south bound.

Frankel: That's correct. And so is Malaccas Straits now. Singapore, for example, quite recently instigated many of the things that I mentioned and they are implementing them within an 24-month period, as a result of many major mishaps in Malaccas Straits.

Unidentified Voice: What you are suggesting is fuzz busters in reverse.

Unidentified Voice: Trouble is, an airline pilot can't throw his box out the window whereas a ship's mariner probably could.

Steele: May I comment on that? I assume you are suggesting that if a ship has no radar, that it cannot be safely navigated into port. I would like to challenge that because even if the radars are down, even if the fathometer is off, even if the collision avoidance system is off, in good visibility, day or night, a ship can be safely navigated into port, no matter what size, by competent mariners.

Frankel: I agree with you. The main thing I'm trying to imply is that this disabled ship should possibly have different sailing directions than the ship in full control of its fathometer, radar, and so on. Maybe it should be requested to go a slower speed or be under more effective control. But considering that we know very little about many of the ships' effectiveness or the ability of the ship's crew, I think we should be able to require them to prove to us that their systems are operational.

Scott: I agree wholeheartedly with the comment Admiral Steele made about vessels being capable of approaching port without operating electronic equipment. However, I do think that Dr. Frankel's observations about the need for equipment under such conditions is worthy of implementation. We must treat ships with great care whenever they enter waters where crowded or unusual conditions exist. Certainly it is worth making available to shore-side authorities information that some or all of a vessel's navigation equipment is inoperative.

Unidentified Voice: Well, we've got some rules in place now that maybe Admiral Benkert would like to comment on.

Scott: That is true, but we don't have the kinds of devices that Dr. Frankel referenced which would enable the mariner to demonstrate quickly that his equipment is or is not operative. If we did, the fact that some equipment has failed would be immediately known by onshore authorities who can then treat any ship experiencing difficulty with special care. There may frequently be circumstances in which the authorities will say to such a cripple, "Come right in. We can handle you safely despite your problems." On the other hand, I see nothing to suggest that having that evidence in the possession of those onshore would be in any way harmful.

I would also like to point out that we may be overlooking the biggest advantage of the "black box"--the opportunity to discover what causes specific accidents. Hopefully, we will use the information to take steps to avoid similar accidents in the future. The *Arizona Standard* and the *Oregon Standard* didn't have black boxes, but Chevron perfomed the same function when it reconstructed the

accident with great attention to detail and then changed its whole method of operation. A "black box" could do this for us more easily and with greater accuracy.

Horowitz: I'm Bob Horowitz with the Coast Guard. With respect to this offshore information system, the department conducted over the last year the offshore vessel traffic management study and it is available as National Technical Information Service report number CG-D-55-78. The study looked at the 200 mile offshore area, what types of passive and active traffic control reporting requirements would be necessary in the interest of safety and environmental protection and its conclusion was that an active system was not required, and that a passive system would be adequate. The recommendation is for a passport system which would require notification by vessels prior to entry to port. So you might want to take a look at this report for that information and its conclusion. The second point is to bring the record up-to-date on a comment that Mr. Russell made about penalties for vessels 200 miles off shore. The 1977 Amendment to the Water Pollution Act prohibits the discharge from vessels in that area, but there's no penalty action to be taken against the foreign vessel unless it is otherwise subject to the jurisdiction of the U. S., which has now been defined as requiring a bilateral agreement connection. So we are still trying to preserve some norms of international law.

Unidentified Voice: In my reading of the 1977 amendment I didn't find the language otherwise subject to the jurisdiction in the clean-up cost portion of the statue that I found for the penalty portion and the reporting requirement.

Horowitz: It doesn't subject the foreign vessel discharger to a penalty. I believe the interpretation now is that the discharger might be responsible for clean-up costs, removal costs. However, he's not subject to civil or criminal sanctions for the discharge.

Russell: That's the very point I was trying to make--that it was the clean-up costs that I felt the law still said the foreign flag vessel more than 12 miles off shore was responsible for. As a comment, I said that had several problems acquiring jurisdiction in the first instance and international law in the second.

Erica Ott: It seems that the general drift has been that human error is the cause of most tanker spills and accidents. What amazed me was Admiral Steele's comment that installing radars at the cost of $40,000 was nothing; the expense could be written off. And then when you said that the cost of physicals was expensive, it floored me because this seemed to be what we need more of and maybe physicals and classroom training might not be too expensive in the long run.

Ernest Altekruse: Last night, during the course of my remarks, I

did not mean to imply that the aerospace industry could solve all your problems. They have plenty of their own. Ask the industry why they don't face passengers backwards in aircraft to absorb impact forces more efficiently and why they put toxic generators in the cabins? The preemployment and the periodic physical as usually performed are almost worthless. What I was implying was, does anyone set operational limits? For example, 366 days at sea is going to lead to fatigue. This is one occupational hazard that could readily be identified. The tanker industry in many ways is similar to the aerospace industry, which has a very good record. It's a lot safer to fly than it is to drive a car. I was of the opinion that minimal operational standards existed for crew members and that none had been established for captains, and I believe at least one major spill was attributed to the fatigue of a captain who had been at sea for more than a year.

Steele: Can I just respond to Ms. Ott? In the first place, I don't think I used the word "write off" and in the second place, I don't underestimate the cost of putting on these things in their aggregate; I just tried to identify each one. Where it became too expensive is that we exist as part of a labor pool and our people rotate through us. I may have a master with me for four months and I give him an extensive physical examination because I don't like the previous physical examinations, and then I get his replacement and give him a physical examination, and pretty soon my company is busy underwriting extra physicals for the entire labor pool of maybe six or seven other companies. I would be giving all the masters, chief engineers, chief mates and the first assistants examinations every year, and if they're over 40 in greater depth; if they're over 50, in greater depth, and so forth. Maybe ARCO can do it, but we're an independent and the cost really mounts up in a staggering way. And it isn't charged against capital expenditure; it comes out of overhead and that's painful.

Unidentified Voice: We've been talking about black boxes and other electronic devices and I think we're all agreed that certain devices (radar, LORAN-C, fathometer, and so forth) are very useful supplements to good seamanship and alert watch-keeping. I think we'll also all agree that these electronic devices are, to varying degrees, subject to malfunctions, are very complicated to troubleshoot and to fix, and they'll stay down until you can get a manufacturer's representative, wherever in the world your ship happens to be, to fix the thing. My question was might there be a chance for some technology transferred from the military; that is, might it not be possible to design some of these systems on a module basis and perhaps have a Coast Guard approved or FCC approved basic electronics course so that some of these common malfunctions don't put the whole system out of action, but so that a properly trained officer would come in, pull out that module, take its replacement and put it in. It seems to me this at least offers some promise for some research and development work and maybe we can take something from our military efforts.

Unidentified Voice: The final comment I wanted to make is in that area. We've already gone a long way in that direction; in fact, the radio officer on most commercial ships is now rapidly becoming an electronics technician to handle the electronic equipment on board. With regard to military technology transfer, I don't want to leave the impression that we're not trying to talk to the aerospace community. The American Institute of Aeronautics and Astronautics, a professional society, the aerospace community, technically. That society and the Society of Naval Architects and Marine Engineers, which represents the technical design engineering part of the marine community, are going to have a joint workshop in about two weeks in Willaimsburg. There will be about seven panels on different technical disciplines with seven representatives from each one of those societies coming together to discuss the problems facing marine industry. They will look at some of the technology that's been developed in aerospace, and try to come up with some suggestions and some ideas of how we can accomplish technology transfer.

Sharon Stewart: I'm Sharon Stewart of Texas Deep Water Port Authority. I wanted to correct an impression that may have been left by Mr. Bardelmeier's comments. The private consitorium of oil and chemical companies known as Seadock, the project on the Texas coast, did indeed die, but the port known as Seadock is alive and well. As a member of that port authority which intends to build it for the state, I want you to know that we expect our license application to be returned within a few months.

TOPIC E

CONCLUDING SESSION

Deborah J. Stirling, Chairperson
United States Senate
Committee on Commerce
Washington, D. C.

We've explored just about every subject that could be explored which deals with tankers and pollution, preventive measures, and related topics. We've looked at institutional initiatives, and incidentally, here I would just say that the exposition Admiral Wallace gave on IMCO and what was behind it was one of the best that I've heard. We've considered the state perspective, especially California's. We've looked at a tremendous number of laws, regulations, treaties, and protocols. We've heard lawyers', economists' and industry's views. One of the high points that I'll carry with me was a humorous note we heard yesterday, and I'm sorry that the gentlemen has left who made the comment. We were told for the first time that the *Amoco Cadiz* spill had a net economic benefit. I think someone ought to get a golden fleece award of some kind for that and I hope that word will get to the Liberian representative. We've talked about a lot of things. Insurance standards still seem to be a puzzle; I don't think we have reached any resolution on that. We certainly have reached a conclusion on crews and crew standards, however, and I believe we all agree that this is an area where improvements must be made. Some steps have been taken at IMCO in this direction, and I think Mike Benkert will discuss this as we move around the panel. We've talked about causation of pollution, operations versus catastrophic events, and although operations are the greater culprit, it's the catastrophic

occurrences that move the public and the system, or so it seems. We've talked about rubber fenders for ships and floating ports. We've covered just about everything, I think, and I'm going to ask our panel to step in at this point and comment. At the end, I'd like to ask Hal Scott as a representative of environmental interests to make some comments about how the conference may have affected his thinking. This has been an extraordinary conference because of the kinds of viewpoints that have been brought together here; we certainly owe a debt of gratitude to our hosts for that. Having said this, let's begin with Trevor O'Neill.

O'Neill: I'm Trevor O'Neill from the state of California. In California, we are trying to respond to problems that we have identified. We recognized that we may not have the in-house technical capabilities to conduct the research and analyses required for some decisions, but, on the other hand, it doesn't always take an expert to recognize where problems may exist, to raise issues, and to bring them to the attention of the experts in the Coast Guard and elsewhere who are competent to deal with these issues. Our concerns are going to continue to exist, and we're going to do the best we can to raise these issues, to voice our concerns, to take positions, and to try to deal in a constuctive, cooperative fashion with industry representatives, federal representatives, and local representatives, trying to make a best fit between the various conflicting interests, trying to achieve what more often than not are our common interests. I want to go out of my way to make a point, if Captain Lynch of Arco is still here. I've worked for about three years for California on offshore oil and gas development and tanker transportation issues and the differences in the corporate philosophies that the different operators have are astonishing. Arco, in my personal opinion, is one of the most cooperative companies to deal with. Some of the companies have adopted a stone wall altitude. I guess they're fed up with California to the point where they don't want to talk to anybody from the state. They have their reasons and we have ours, but Arco has consistently been one of the most open and cooperative companies in helping us to administer our laws and regulations and to pursue the interests we perceive as vital. They help us match what we're trying to do with industry practices and the constraints that industry operators are under; it's very helpful to have that feedback from the industry so that we can keep our ideas as close to reality as we can. As I say, I think we are going to continue to be active in raising issues, taking positions and discussing possible changes and things that we can do. I hope that we can continue in this spirit of constructive cooperation, because I think we get a lot more accomplished that way.

Stirling: Mike.

Benkert: There are two points that have been brought up during the discussions without a presentation of what I feel would be a solid approach to them. One of them is the subject of classification societies; after talking with people here, I know that some of them

are not fully acquainted with what a classification society does and is. In short, the classification society, of which there are many, is an organization such as the American Bureau of Shipping, home-based in the United States, Lloyd's Britain Bureau Veritas, Norske Veritas, and so forth. These societies are really ship owner/insurance oriented, in the sense that the ship owners in fact, originally created them essentially for insurance purposes. The point of the classification societies was to provide a service to the ship owner, to look at the ship owner's vessel under some set of ground rules and to be able to effectively certify that the ship owner's vessel was in fact sea worthy, that is, in compliance with classification rules. That is one function of a classification society. There is another function today, and this is where you get into some real complications. This is why some of the provisions of the tanker safety work that was done in February at IMCO deal so extensively with the subject of inspection and certification. A number, of classification societies act, not only on behalf of a ship owner for class/insurance purposes, but also on behalf of a government in determining a vessel's compliance with international conventions. For example, for a large number of countries, the American Bureau of Shipping acts as a vessel certifying authority. The ABS will inspect the vessel and issue a certificate indicating compliance with the Loadline Convention, or with the Safety of Life at Sea of the 1960 Convention, and so forth. The classification society has two hats, one which it wears on behalf of the ship owner, the other on behalf of the government to ensure compliance of a vessel with international agreements. In the United States, the Coast Guard performs this governmental function, if you will, of certification and ensuring that the vessel complies with international conventions. In most other countries of the world this is not true. Most other countries do not have inspecting and certificating forces; they utilize the services of a classification society. So one of the problems in looking at vessels, substandard vessels particularly, and substandard vessels operated by substandard owners, is that in many cases, the determination of "substandard" is done by an organization which is not only working for the government to determine whether that vessel is substandard but is also working for the shipowner for classification purposes. Now, there is nothing basically wrong with this, in my opinion, assuming, as is true, that in the vast majority of cases the classification societies do an excellent job of ship surveying and determination of the condition of vessels; in other cases, it doesn't work as well. If a substandard owner is "shopping around" for a classification society which will treat him softly, shall we say, he can find one. So he puts his vessel in class with an outfit which perhaps does not look at a vessel too closely for either classification or for certification purposes for the government whose flag that vessel is flying. When we were dealing with this subject in preparation for the the TSPP Conference, this was one of the areas of much pro and con discussion because some of the classification societies, although they are in fact acting as governmental agents, don't

like to consider themselves in that capacity; this does sometimes create a problem in determination of substandard vessels. To conclude, the subject of classification societies is rather complex.

Now, if I might just take one more minute on the Training and Watchkeeping Conference, without going into all the ramifications of the conference and the Convention which was developed this last June and July, I would like to mention specifically the resolutions of the Conference which are appended to the Convention. One of the things brought up is germane to what was mentioned this morning about crewing vessels with personnel from lesser developed countries, which, for example, have had little or no capability for the training of their citizens for jobs aboard vessels. One of the things which was brought up by developing countries, and strongly supported by the United States and a number of other developed countries, or if you want to call them in this context, "old line maritime nations," was that they felt that if they were to agree with the provisions of the Conference and the subsequent Convention, they should be able to look for help in training, and in furnishing technical assistance for their people. There are two resolutions appended to the Convention itself which specifically deal with the intent of the IMCO community to provide such assistance for these countries, and I think, it creates a specific perhaps, and certainly a moral responsiblity for the developed countries to try and upgrade untrained personnel. I think you are going to see more of this in the future, especially by responsible ship owners who are doing this today particularly for their "foreign flag vessels," many of which are American owned vessels under foreign flags crewed by foreign personnel. One of the things which may not have come up here is that we are one of the few countries in the world which requires that essentially all crew members of United States flag vessels be United States citizens. Other countries may have limited requirements for certain personnel to be citizens, but the United States has essentially a blanket U. S. citizen requirement with a few exceptions allowed depending on circumstances; for example, a small percentage of resident aliens can be aboard our vessels. A foreign-flag vessel with the flag of country X may have people aboard that vessel from countries Y, Z, A, and B; this obviously creates an entirely different concept, particularly when you are talking about training personnel for those vessels.

Thank you for giving me this time and I would also like to thank Admiral Wallace and the Baruch Institute. I have enjoyed being here immensely.

Stirling: Sid Wallace.

Sid Wallace: On behalf of the Department of Transportation I would like to thank you all for being here, thank the University of South Carolina's Baruch Institute for doing a fine job, and again recognize Ernie Altekruse who was the catalyst throughout.

The only thing of substance that I would add to what has been said by others, and by me yesterday, is the expression of a strong personal view that the time has come for a period of implementation

and of stability in all this. The time has arrived when we should attempt to realize the benefits of the laws and agreements that have been adopted and to assess the results through practice. It's time for some clean up sessions in international forums; IMCO is proceeding rapidly with implementation measures. Implementation is proceeding well. In the Congress and in the Executive I do plead with state government representatives, with state governments; please no new initiatives for a while. We need to realize the benefits of what we already have but have not yet implemented. Let's keep talking, but let's take the time to see how we've done by putting the new rules into force.

Stirling: Bob McManus.

McManus: Let the record show I have a number of questions and comments in respect to the nitty-gritty I've heard discussed in the last two days. But inasmuch as this is my parting shot, I would like to add to your confusion by pointing out both a paradox and an irony that have been present throughout many of our deliberations in the past two days. First, with respect to the paradox: I suggest that California is to the United States as the United States is to the community of nations that makes up IMCO, and I would suggest furthermore that both California and the United States, in varying degrees, have, as an ultimate goal, the elaboration of good, uniform standards pertaining to tankers and the prevention of pollution. The paradox is that in order to pursue this goal, California, for example, does not wish to be pre-empted. California thinks--with some justification--that if it has the power to establish the scope of damages under a state liability law, for example, the United States Congress will come out with a better liability scheme, if and when it ever acts on the Superfund Legislation. By the same token, the United States in the IMCO forum knows full well that, had we lost the vote on the abortive Article 8 in the 1973 negotiations, then IMCO standards as they exist today-whatever their faults and benefits--would probably not be as good as they are. That is, if we do not have the leverage as coastal or port states to move unilaterally and to let it be known that we have that leverage and would use it if pushed to the wall, you really can't expect the supra-national authority to behave as responsibly. I expect that the same kind of logic underlies California's feelings about federal pre-emption. The paradox is that if you want *good* standards, then the state (or, with respect to IMCO, the federal government) ought to have some unilateral standard-setting authority; but if you want *uniform* standards they ought not have such authority. There is tension here; and, while I really don't know how to resolve it, I suggest that we look at it in that way. Then we might not be so inclined to "dump on" Mr. O'Neill, and perhaps some of our maritime allies would not be so inclined to "dump on" Admirals Wallace and Benkert et al. when they attempt to negotiate in an international forum.

This brings to the irony I mentioned as has been recognized, oil and other pollution from tankers are minor components of a

global problem. That problem has to do with the continued viability of the ocean ecosystem. It has to do with heavy metals, transuranics and other pollutants besides oil. I have participated in many discussions of the global problem, and it is remarkable how unfocused such discussions are when compared and contrasted with the deliberations of a group such as this. The irony is that we all sit here while our legislators sit in Washington and devote a good deal of attention to oil pollution from tankers; but nobody really seems to know how to get a handle on the broader problem, either in terms of the goals we wish to pursue or in terms of the modalities by which we might pursue them.

Russell: I've tried to talk to you a little bit about some of the after-the-spill machinations that inevitably will take place, which is not to suggest that many responsible operators don't go right out and clean up their spills. It is the irresponsible ones we must focus on. I do leave you with this small observation that you may or may not connect with the legal process. The lawyer returning to his office at the end of a long and rigorous trial telexed his client overseas with the simple report of the result "Justice triumped!" In return the client telexed "Appeal at once."

Steele: I'd like to throw one more iron in the fire and that's communications. I think I mentioned in my little talk that we have satellite communications on three VLCC's. Some of the ships we run we operate for others; we operate VLCC American flags. I have attempted to persuade the owners to fund the addition of satellite communications on those; but, in view of the size of the investment, without much success I'm sorry to say. When we find it possible, when passing the Cape, to cancel a helicopter rendevous at the last moment because somebody didn't show up, with "SATCOM" we can do it and thereby save $1,500 or $2,000. If I were using the routine method of communication I wouldn't dare call it off because the ship could sail on and the helicopter would be up in vain. In such a case I can get the agent to stop the helicopter, maybe, but the ship may loiter around looking for it because I can't tell him it is cancelled fast enough; but, with satellite communications we can get the ship, and have the answer back, "Yes, the Master understands" in just a matter of a few minutes. I'd like to illustrate my point further. A ship off the horn of Africa suddenly lost a transition piece, an enormous flexible joint which connects circulating water from the sea to a condenser; the engine room flooded. We couldn't talk to the ship directly; we had to talk via passing ships. Messages were relayed through foreign radio stations in the Persian Gulf area. Delays in transmission were twelve to twenty-four hours, and then they sometimes came through improperly. We were trying to arrange salvage if necessary. We didn't know whether the ship was still afloat, or how bad the damage was. It was just impossible to really understand the situation for a couple of days. With satellite communications, we could have been right through on the phone. In another case, we had a ship on which people were unconscious in a tank, and the time lag between talking to the ship and

the home office was six to twelve hours. I'd send a message to him, he'd get it six to twelve hours later and send a response back to me. I'd get it six to twelve hours later. You can see the time loss. The master and the chief mate were both in the tank unconscious. The second mate had taken over with only a third mate, and they were trying to do a rescue job. They got completely exhausted; their minds weren't functioning well. Had we been able to be on a dedicated private circuit without the underwriters and the lawyers and the "ambulance chasers" listening in, which risks tremendous liability, we could have provided at least verbal assistance. You just can't say exactly what's happening by ordinary cable, because everybody can read that, the salvors in particular. Had we been able to utilize a private line, some expensive mistakes would not have been made, because somebody with a fresh mind ashore could have helped. For example, an astronaut in trouble in space has Houston to tell him how to come out of his trouble. They can say push this button, try that system. I suggest that maybe you'd want to add satellite communications to big ships, if you have a shopping list.

Stirling: Thank you, George. Hal.

Scott: These have been very constructive discussions.

There is always a tendency for groups as diverse as those represented by the interests gathered here to look upon each other in terms of caricatures and to communicate with others through slogans. When so unusual a group is thrust together for a day and a half it ultimately becomes necessary to dispose of those caricatures, to dispense with the posturing and to deal with each other as real people.

Those of us who rarely, if ever, converse with those we sometimes view as our "adversaries," discover in Sid Wallace and Mike Benkert warm, cooperative human beings instead of the oft imagined unbending, uncompromising products of a military life. Having had no previous contacts with independent tanker operators, the opportunity to exchange views with George Steele and Mr. Naess enabled me--and I suspect others like me--to disabuse myself of preconceptions which would normally inhibit constructive discussion between us. As a result, the conversations which have taken place here have enabled us to deal realistically with problems that relate to the utilization of our marine transportation system to safely move oil and other hazardous materials.

I agree with Bob McManus' observation that there are matters far more pressing, far more dangerous, and capable of having a far greater negative effect on the ocean environment than does oil to which our attention has been directed. But I do not view the oversight to be a fatal flaw in our conversations. We have accomplished much of what we set out to do. Hopefully, in other discussions we can pursue those other problems to which Bob referred.

I would love to be able to tell Sid Wallace, for whom I have great respect and affection, that he would hear no demands for new initiatives from my associates and me. That is not possible. Conservation groups need to support the Coast Guard's efforts to

implement--digest as it were--all that has been accomplished in recent months and years. But we need also to insist that those improvements in the marine transportation system that can be made, be implemented as soon as they can be shown to be cost effective.

Recognizing fully that tanker accident rates are very low, we still want to see those rates reduced. If you are a Frenchman, the grounding of the *Amoco Cadiz* resulted in enormous losses that affected your life in ways too numerous to list. No amount of statistical data can lessen those impacts.

In discussing the matters to which we have directed our attention here it is important that we all recognize how very little we really know about the effects of oil on the marine environment. We have thus far even failed in our feeble efforts to phrase the questions to which answers should be sought. It is not surprising, therefore, that the "answers" that surface in a group such as this are so diverse, so at odds one with another, that one is reminded of the Tower of Babel.

Our educational system was once described as an effort to teach the next generation of leaders how to deal with tomorrow's problems by utilizing yesterday's solutions. I cannot help but feel that many of the problems the marine transportation system faces today emanate from a similar myopia. It is for that reason that people like Trevor and Anita and I--despite our lack of experience--are going to keep pushing for an even better marine transportation system. That is what we can best contribute to our society. As a result of our conversations--of the sharing of ideas that has occurred here, we will be able to make that contribution in a better informed, more constructive fashion than had this meeting not taken place.

Having spent 21 years in the insurance business, I feel obliged to make one other observation: If you expect the insurance business to operate logically, you are expecting too much. Mr. Hetzler noted yesterday that insurors who once operated in countries like Norway where there were large fleets at risk are now seeking to insure ships elsewhere in the world because so much of Norway's fleet is tied up--unused..

Twenty-one years in the insurance business taught me that no matter how bad a risk is, someone will always insure it. That is why vessels like the *Argo Merchant* roam the seas--accidents waiting to happen. It is a built-in trait of the insurance industry with which I do not know how to deal. My own experience was in the contract bonding business, but the problems I recognized there exist as well in the marine insurance industry. The similarities between the contract bond underwriting and marine underwriting are too significant for it to be otherwise.

Finally, I think that this meeting forced each of us to more closely examine our conclusions, our "answers" and our prejudices and to try to understand the concerns of others. Georges Bernanos, the French author, once wrote "The worst, the most corrupting lies are problems poorly stated." If we have accomplished anything of value here--and I believe we have--we will take with us as we leave this place a determination to more accurately define the problems we share. I consider that to be a meaningful contribution

in an area of public debate which too frequently involves forces so polarized that constructive communication between them is impossible.

Thank you--each of you--for helping me to better understand your problems and your hopes and, in the process, reminding me of the need to avoid the arrogance of certainty.

Stirling: I think that's an excellent summation. Before we hear from the rest of the participants, I want to take the chairman's prerogative and do two things. First, I want to take this opportunity in my official capacity as a staff counsel for ocean policy for the Committee on Commerce, Science, and Transportation to recognize the tremendous effort that Admiral Benkert, now retired, and Admiral Wallace carried on and the tremendous success that they and the entire IMCO delegation led the country to. Second, I think we should take the time now to recognize Dr. Ernie Altekruse, Admiral Sid Wallace, Dr. John Vernberg, Dr. Winona Vernberg, The Baruch Institute, and the staff here at Hobcaw Barony for the tremendous job they've done in facilitating this meeting which has been highly successful. Now we'll hear from the rest of the participants. Bill Bardelmeier.

Bardelmeier: I'm rather taken aback by the attitude that's crept in here today casting a little doubt on the classification societies. I'm not an apologist for them, but I am fairly familiar with the genesis of classification societies, and I'm a little surprised at the slant that's crept in here. Mike gave a very lucid explanation, and I'm not quibbling with what he said, but I want to bring out a point. The point is important to me, because in an earlier conversation Mark Zacher indicated to me that he had had personal indications that classification societies were populated by dishonest persons on the take, and that this may be a serious safety problem in shipping. I told Mark then that in my professional career I had never really thought this was a serious problem. I recognize there can be bad apples anywhere, but I thought the integrity of the major classification societies is beyond doubt. This has been my personal observation throughout. There are independent surveyors who are not in any way connected with classification societies around the world that I wouldn't trust as far as I could throw them. I always recommend that clients take a surveyor they can trust and pay his air fare everywhere rather than pick people like that at random. However, regarding the origins of classification societies, I think you all should recognize that they don't really just work for the shipowner. Mike made this point properly. The ship owner pays the fees but the societies are looking after the interest of underwriters and investors, and they pass objective rules for building good ships. Their services really originated for the benefit of the underwriters. The grandfather of them all, Lloyd's Register, exists because historically the guys in Lloyd's Coffee House wanted some proof that the vessels they were going to insure were insurable, and so they created this body to look after their interests and to

lay the bill for the services on the ship owners, and that's the way its been for a long time. The shipowners have fairly little control over the classification societies. I think you all should be aware that when one says that a ship is in class, it is very easy to leap beyond the things that are involved in classification to include all kinds of other safety features. I think you should all know that the rules of classification are in one little book entitled, "The Rules for Building and Classifying Steel Vessels". In the case of ABS you can probably find another one for yachts and so on and it doesn't say one word about radar sets or necessary communications facilities. It does say how thick the steel will be and how far apart the frames will be spaced, and even how big the diameter of the anchor chain will be and what the anchor will weigh but it doesn't get into these safety things as does IMCO. My point here is to distinguish between those two, because when somebody says the "*Argo Merchant*" is in class she can be totally in class, and have a deplorable lack of vital equipment that has nothing to do with classification.

Zacher: First of all I would like to extend Bob McManus's comment regarding as California is to the U. S., so the U. S. is to the international community. With California, I would, however, like to lump the U. S. environmentalist groups, because, insofar as a state such as California puts pressure on the government to seek certain international accords, so do the environmentalists groups. The influence which U. S. environmentalist groups have had on their own, and through working with particular legislators and with some bureaucrats as well, has had a very profound and beneficial effect on U. S. policy and hence international conventions during the 1970's. Secondly, I would just like to reiterate Sid Wallace's comment that the absolute priority item for everyone concerned with the environment now, is the implementation of what we have on the international books. What we have is extremely good and a diversion of energy to thinking about what regulations might be promoted internationally or unilaterally might, in fact, have an overall negative impact. Thirdly, after the entry into force of what we already have internationally, the key issue is enforcement. There are a variety of ways that this can be done, and in connection with this, let me say that there are a number of ways, to use Carlton Russell's terminology, that the "dirty dozen" or however many there are--could be identified and that public pressure could be exerted on them. If information now being gathered through the U. S. boarding program could be sifted very carefully by non-governmental groups as well as by congressional committees, the identity of these "dirty dozen" could be made public. Equivalent information is now being secured by IMCO through its gathering of information on casualties, polluting casualities, and the action of flag states regarding polluting incidents by their vessels. There's a lot of data there that could be examined and which environmentalist groups or congressional groups could look at. It might be a little more difficult for executive agencies to do this, but other bodies could do this.

Stirling: If I may break in, I would say that we do have people in various offices who are responsible for keeping up with this on a constant basis.

Zacher: Well, I haven't seen too much of it, at least in published form.

Stirling: No, there hasn't been, that's true.

Zacher: But the data is for the first time beginning to become available. Lastly, in connection with the compliance problem, let me just comment on what Bill Bardelmeier said. I think that with respect to the classification societies there is really little question that their initially putting the vessels into class is quite good. This basically takes place at the shipyard and I haven't heard any serious complaints about the standard of their work in this area. The main problem arises with respect to their granting of periodic certificates which they do on behalf of governments regarding construction standards and equipment standards. In some cases they do grant certificates when the vessels do not meet the required standards. For the most part the exclusive surveyors are not a serious problem. When you get to the non-exclusive surveyors, there certainly is a problem and, in fact, former Coast Guard Commander McCurdy has written several articles on this particular problem. A certain amount of effort on the part of governments to look at what societies are doing in this area, such as the Coast Guard does with its own program, would be very desirable, not just on a national level but on a multi-national level.

Stirling: Thank you, Mark. Harvey.

Silverstein: With the possible exception of Mark Zacher, this has been an American conference made up of Americans taking an American perspective on a small part of what Bob McManus has clearly identified as a much larger issue. This brings me immediately to something Mike Benkert triggered because I think it relates to something that could be done practically by the Coast Guard and by other people here and has to do with the training programs IMCO now sponsors. IMCO has a series of regional training centers in developing countries which are communicating technical information to people in these countries. The developing countries have very different environmental values or concerns from ours. By and large, they see environmental issues as peripheral and unless they hold environmental concerns in at least a higher sense than they do now, all the laws in the world are not going to solve the problem of releases into the ocean. IMCO spends more than two million dollars a year on training, in fellowships, two regional training centers, on exchange programs, in technical assistance programs, and this is not their own money. It's money that they administer for UNDP. One thing I've never quite understood, at least in the past, is that U. S. participation and contribution to these programs has been minimal both in terms of personnel and expertise, and it's been

primarily the European nations which have sent the experts to Brazil, to Bulgaria, to Africa, where the programs have grown out. Why can't the Coast Guard, to some extent take part in these international exchanges, and participate in the educational process with the end result of hoepfully changing some of the values of the people directly involved in these questions in these developing countries?

Steele: I don't know whether you noticed my comment that I had to bring people from Britain to the United States to teach inert gas. Our ships are older, the foreign fleets are newer. Their equipment in many cases is better, and maybe we ought to give a grant to the Britains or to the Germans or the Dutch to send their people to teach because they are often better than ours.

Wallace: Harvey, we do support IMCO. You indicated that IMCO spends UNDP money. About half the UNDP money comes from the United States, we remind you, and secondly, we certainly are giving them all kinds of technical support. Admittedly, we haven't been sending a lot of people to developing countries and other places where they are needed, but we're in the process of looking at that again, at a whole host of opportunities to do so. Additionally, we are probably going to provide a permanent representative over there, UNDP funded, beginning the first of January, so that's all been planned.

Stirling: Good, thank you, Sid. Dr. Altekruse.

Altekruse: I thank all of you for your cooperation. We will send out the transcribed notes to everyone for their perusal and corrections. We also will consider any references that you want to insert, for example unpublished papers you have authored pertinent to the subject. If you wish to have included any short papers that expound on some of your comments, panelists, please send them to the Baruch Institute.

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