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Marine Industrial Technology

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EMERGING TECHNOLOGY SERIES: MARINE INDUSTRIAL TECHNOLOGY 2/1996

CONTENTS

UNIDO's *Emerging Technology Series: Marine Industrial Technology*, is established as a mechanism of current awareness to monitor developments in the marine industrial technology sector and to inform governments, industry and academia, primarily in developing countries.
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Dear Reader

The United Nations Industrial Development Organization (UNIDO), is the specialized agency of the United Nations dedicated to promoting sustainable industrial development in countries with developing and transition economies. It harnesses the joint forces of government and the private sector to foster competitive industrial production, develop international industrial partnerships and promote socially equitable and environmentally friendly industrial development. It acts as a catalyst to help generate national economic wealth and raise industrial capacity through its role as a world-wide forum for industrial development and as a provider of technical cooperation services.

Technological innovations are considered to be continuously necessary to establish new industrial production facilities and to improve the productivity of existing units.

Marine technological developments are intimately connected with other high-tech endeavours, especially in the fields of micro-electronics, including robotics; genetic engineering and biotechnology; space and lighter-than-air technologies; and materials technology. There is a need to monitor developments in these fields for their complementary and competitive impacts. The complementary impacts would be the developments they could generate in marine technology; e.g., space technology and micro-electronics on environmental pollution monitoring; biotechnology on the leaching of minerals and on mariculture, etc.. At the same time, the impact of these developments on land-based industries have also to be taken note of. For a resource to be exploited, not only has it to be accessible with the technology available to exploit the resource, but the exploitation has also to be economic. In the case of ocean resources, it would mean extracting resources at an economic price competitive with resources from land-based sources. Thus, the increasing efficiency of land-based mining due to technological advances, would have a competitive impact on ocean technology.

The idea underlying the development of technology is the exploitation and utilization of marine resources, whether living, non-living, energy-related, or for extending "space".
Anthony Bromley, Technical Editor

CONTENTS

A. COASTAL ZONE MANAGEMENT

Agriculture in the coastal environment[1,2]

By Dr. A. D. Insull

Paper prepared for International Course on Coastal Zone Management, 19-30 October 1992, Villa Duodo, Monselice, Italy

1. Introduction

Aquaculture interacts with the environment. It utilizes resources and causes environmental changes. Most interactions have beneficial effects. There have been substantial socio-economic benefits arising from the expansion of aquaculture. These benefits include increased income, employment, foreign exchange earnings and improved nutrition. Unfortunately, some coastal aquaculture practices have resulted in adverse effects on ecosystems.

There is concern about the potential environmental implications of coastal aquaculture development, comprising the adverse effects of aquaculture operations on the environment as well as the consequences of increasing aquatic pollution affecting feasibility and sustainable development of aquaculture. Environmental problems have resulted from conversion of wetland habitats, nutrient and organic waste discharges, introduction of exotic species, and chemical usage, as well as from deterioration of water quality and decreasing availability of suitable sites for aquaculture.

These notes are intended to (1) summarize existing and potential environmental interactions of aquaculture in coastal areas and (2) to highlight possible measures to achieve environmentally acceptable and sustainable development of coastal aquaculture.

2. Environmental interactions of coastal aquaculture

2.1 Degradation of coastal environments and potential effects on coastal aquaculture

In many coastal areas, pollution and habitat modification stemming from human activities other than aquaculture are increasingly affecting resource use productivity of aquaculture as well as limiting success and development possibilities of the aquaculture industry.

High organic and microbial loading in sewage discharged from densely populated urban and resort areas can contaminate cultured shellfish, thereby rendering this aquaculture produce unsuitable for humans, particularly if consumed raw or partially cooked.

Heavy metals found in industrial effluents may be found in the animals cultured in the receiving waters. Potentially hazardous substances include mercury, cadmium, lead, copper and arsenic.

Serious oil spills can cause large-scale fish kills, and obvious effects on aquaculture include the contamination of farming structures and tainting of farmed organisms.

High levels of pesticides stemming from agricultural run-off, can be lethal to cultured organisms, while lower doses are believed to produce sublethal effects such as pathological changes in various organs.

The release of inorganic and organic nutrients into marine ecosystems can cause hypernutrification and possibly phytoplankton blooms. Cultured fish can be killed by algal blooms through sudden water quality deterioration (suffocation due to gill damage and/or oxygen depletion) after collapse and decomposition of a bloom. In particular, bivalve culture is facing serious problems associated with the increasing occurrence of toxic phytoplankton blooms caused by a relatively small number of algal species producing a range of toxins, the effects of which include mortality of cultured stocks, as well as human illness and even death after consumption of contaminated bivalves.

2.2 Potential adverse ecological effects of coastal aquaculture

(a) Nutrient and organic enrichment

Many aquaculture operations invariably result in the release of metabolic waste products (faeces, pseudo-faeces and excreta) and uneaten food into the aquatic environment.

The release of soluble inorganic nutrients (nitrogen and phosphorus) has the potential to cause nutrient enrichment (hypernutrification) possibly followed by eutrophication (increase of primary production) of a water body. Related changes in phytoplankton ecology may result in algal blooms, which can be harmful to wild and farmed organisms.

The largest proportion of solid wastes released, which is predominantly organic carbon and nitrogen, settles to the seabed in the immediate vicinity of the farm. Organic enrichment of the benthic ecosystem may result in increased oxygen consumption by the sediment and formation of anoxic sediments, with, in extreme cases, outgassing of carbon dioxide, methane and hydrogen sulphide; enhanced remineralization of organic nitrogen and reduction in macrofauna biomass, abundance and species composition.

There is evidence of very localized effects of reduced concentrations of dissolved oxygen in bottom and surface waters close to farm sites which are due to the considerable biochemical oxygen demand of the released organic wastes and the respiratory demands of the cultured stock.

(b) Degradation of wetland habitats

Coastal wetlands such as mangrove swamps are among the most productive ecosystems sustaining the ecological integrity and productivity of adjacent coastal waters, and are important breeding and nursery grounds for many commercially exploited fish and shellfish species. Several tropical countries have lost extensive mangrove areas due to clearing and conversion to fish and shrimp ponds, often accompanied by salinization and acidification of soils and aquifers.

(c) Use of chemicals

A variety of chemicals are used in coastal aquaculture. These include: therapeutants, disinfectants, anaesthetics, biocides, hormones and growth promoters to control predators, prevent and control diseases and parasites and to alter sex, productive viability and growth of cultured organisms. Current concerns centre on: the longevity of bioactive compounds in animal tissues, the fate and effect of these compounds or their residues in the aquatic environment (e.g., toxicity to non-target organisms) and the stimulation of antibiotic resistance in microbial communities.

(d) Biological interactions

The introduction and transfer of species and breeds for aquaculture purposes may alter or impoverish the biodiversity and genetic resources of the marine ecosystem through interbreeding, predation, competition, habitat

destruction and, possibly, through the transmission of parasites and diseases.

Large-scale cultivation of bivalves in coastal embayments can interact with the marine food web by substantial removal of phytoplankton and organic detritus, as well as by competing with other planktonic herbivores.

Diseases may occur since many aquaculture practices and conditions around aquaculture operations can be stressful to the farmed stock. Stress increases susceptibility and predisposition to infectious diseases. Certain water quality conditions enhance virulence of potential pathogens. In the presence of stress and the appropriate pathogen, disease outbreaks can ensue.

2.3 Self-pollution in coastal aquaculture

It is often coastal aquaculture itself which is affected by ecological changes deriving from farming practices. For example, water currents may be reduced significantly due to farm structures (cages, pens, rafts, etc.), which may lead to increased deposition and accumulation of organic wastes underneath or around the farming unit, increase in siltation and water quality deterioration (e.g., increase in turbidity due to high content of suspended matter). In addition, oxygen supply may be reduced, and outgassing of hydrogen sulphide and methane from bottom sediments may occur which will further affect growth performance and increase susceptibility to disease.

Pond culture which relies on tidal flow or pumping for water exchange may also face a steady increase of water quality deterioration. For example, total water exchange requirements of intensive shrimp pond systems will often exceed the flow rate of the tidal creek that serves as the supply canal and drainage ditch. The net result is that instead of replacing waste with clean water, these farms are very often recycling waste water. Extensive culture systems relying on the natural productivity of waters used may reduce or deviate water flow through farming structures and heavy siltation, thereby reducing the availability of food and nutrients.

Chemicals used may also present a potential risk to cultured organisms and may result in contamination of aquaculture products, which reduces product quality and consumer acceptance. The development of drug-resistant pathogens, resident (and possibly dormant) both within and around the farming unit, may have serious negative feedback effects on farm productivity. The over-use of chemicals in hatcheries may result in reduced fitness, poor growth and decreased survival rates during the grow-out phase. Pond soils may be rendered less suitable by excessive chemical treatment.

The magnitude of negative ecological feedback effects of coastal aquaculture practices may increase with expansion and/or intensification. An increase in the acreage and/or number of farming units (ponds, racks, rafts, cages, etc.) and farms may be followed by a deterioration of the required environmental quality within and beyond the aquaculture area.

As a result of the expansion of farming systems relying on naturally available food and nutrients, the natural productivity of water bodies in coastal areas may be exhausted. Large-scale coverage and degradation of tidal habitats, including mangrove areas, may also affect wild seed supply. Aggregations of farms will exhibit cumulative effects of waste release and increased oxygen demand. Negative feedback effects of siltation, turbidity, build-up of organic-rich sediments, hypoxic or anoxic bottom waters, toxic outgassing, spread of diseases, etc., may then affect all farms in the area, particularly when located in sheltered and shallow coastal embayments with low water exchange rates. Land-based farming systems have faced similar problems, in particular when farms are clustered on suitable sites which resulted in very serious self-pollution problems.

2.4 Social implications of coastal aquaculture developments

The environmental impacts of—and on—coastal aquaculture may have serious adverse socio-economic and human health implications.

Large-scale mangrove conversion for shrimp and fish farming in Latin American and Asian countries in some cases has affected rural communities which traditionally depended on mangrove resources for their livelihood. The expansion of shrimp mariculture into mangrove habitat in some cases involved the transformation of a multi-use/multi-user coastal resource into a privately owned single-purpose resource. The costs of coastal ecosystem disruption for society included coastal erosion, salt-water intrusion into groundwater and agricultural fields, and a reduction in the supply of a wide range of valuable goods and services produced from the resources available in mangrove forests or other coastal wetlands.

Some large-scale aquaculture enterprises displaced small-scale fishermen and aquaculturists. Competition for land and water resources also resulted in use conflicts, sometimes with ensuing violence.

Several economic disasters due to significant aquaculture production losses have been attributed to self-pollution as well as to increasing coastal water pollution which fuelled disease outbreaks and harmful phytoplankton blooms.

Consumption of raw and partially cooked shellfish grown in coastal waters receiving high organic and microbial loadings from urban sewage effluents can result in severe consequences for human health, including gastro-intestinal disorders, gastro-enteritis, infectious hepatitis, cholera and typhoid fever. Heavy metal pollution originating mainly from industrial discharges carries the risk of seafood contamination and human poisoning. Various forms of shellfish poisoning in humans such as PSP (paralytic shellfish poisoning), NSP (neurotoxic shellfish poisoning), DSP (diarrhoeic shellfish poisoning) and ASP (amnesic shellfish poisoning) are occurring world-wide due to consumption of shellfish which accumulated phytotoxins stemming from toxic algal blooms. Effects of poisoning include gastro-intestinal disorders, respiratory paralysis, memory loss and death.

In summarizing, the potential negative implications of ecological degradation affecting directly or indirectly the socio-economic conditions within the environment of coastal aquaculture would include the following:

- Decline in quality and quantity of food fish, both cultured and captured;
- Increased human health risks and reduced nutritional status;
- Reduced consumer confidence and decreasing fish marketability within local, national and international environments;
- Increasing resource-user conflicts and growing competition for markets and credits;
- Decline and failure (collapse) of aquaculture enterprises and/or other fishery practices (e.g., artisanal fisheries) including the post-harvest sector; and
- Social disruption within the rural environment following:

- Displacement of traditional community-based activities in agriculture, forestry and fisheries;
- Decreasing employment opportunities; shift towards unskilled and seasonal labour;
- Marginalization of resident resource-users and non-resource users due to increasing income distribution changes;
- Migration towards urban centres.

3. Planning and management measures for environmentally acceptable coastal aquaculture development

There are a variety of activities which can be undertaken to promote environmental management of coastal aquaculture and to achieve its successful development. Some general principles and policies are presented which may guide coastal aquaculture development planners in the implementation of possible management measures.

3.1 Some general principles and policies

General principles

- Coastal aquaculture has the potential to produce food and generate income contributing to social and economic well-being.
- Planned and properly managed aquaculture development is a productive use of coastal areas which should be undertaken within the broader framework of integrated coastal area management plans, according to national economic objectives and national goals for sustainable development.
- The likely adverse consequences of aquaculture and other coastal developments on the social and ecological environment must be predicted and evaluated, and measures formulated in order to contain these consequences within acceptable, predetermined limits.
- Aquaculture and other activities in coastal areas should be adequately regulated and monitored to ensure that adverse effects remain within predetermined limits and to detect when contingency and other plans need to be brought into effect to reverse any trends which could lead towards unacceptable environmental consequences.

Policies

- The sound utilization of the ecological capacity of the coastal area to produce aquatic products and generate income.
- The development of policy and management mechanisms to reduce conflict with other coastal activities.
- The prevention or reduction of the adverse environmental impacts of coastal aquaculture and other coastal activities.
- The management and coordination of aquaculture activities to ensure that their adverse impacts remain within acceptable limits.
- The reduction of health risks from the consumption of aquaculture products.

3.2 Possible actions to enhance understanding of the interactions between coastal aquaculture development and the environment

Benefits

- Emphasize the socio-economic and ecological benefits of coastal aquaculture. Collect and provide information on opportunities and achievements in coastal aquaculture development.

Adverse effects

- Enhance awareness and understanding of the potential adverse environmental effects of coastal aquaculture. Address both the bio-physical and socio-economic aspects of environmental interactions associated with coastal aquaculture activities.
- Distinguish between the species cultured, the farming methods applied and the prevailing ecological characteristics of the aquaculture site. Encourage research on ecological interactions of coastal tropical aquaculture.
- Emphasize the risks of self-pollution and other negative feedback effects. In particular, address the self-pollution risks of increasing aggregation of aquafarms in coastal embayments.
- Consider aquaculture as one of many activities in coastal areas. Multiple resource use in coastal areas in many cases results in serious pollution of coastal waters. Highlight possible threats to aquaculture due to increasing pollution in coastal areas.
- Address potential negative social implications of aquaculture and other developments, in particular human health risks, resource use conflicts and possible marginalization of low-income groups.

Factors

- Determine the factors affecting environmental compatibility of coastal aquaculture in your project or country. Specify causes of environmental mismanagement and constraints to sustainable development of coastal aquaculture.

3.3 Possible actions to properly assess environmental hazards and impacts of coastal aquaculture

General

- Assess the capacity of the coastal ecosystem to sustain aquaculture development with minimal ecological change.

Pollution assessment/monitoring methods

- Promote understanding of the environmental capacity concept. Encourage application of coastal pollution assessment methodologies such as the hazard assessment approach and adequate monitoring schemes.
- Apply, where possible, pollution assessment methods which are specific to aquaculture. Ensure their appropriate use based on proper understanding of their applicability and limitations. Encourage further development of assessment methods suitable to aquaculture practices and ecological conditions in tropical environments.
- Integrate agriculture-specific monitoring schemes into existing coastal water pollution assessment activities. Select appropriate monitoring parameters and suitable sampling stations.
- Employ remote sensing techniques and geographical information systems (GIS) to assess large-scale spatial and temporal environmental changes due to aquaculture and other developments in coastal areas.

Implementation of environmental impact assessment (EIA)

- Enhance awareness on advantages and limitations associated with the implementation of EIA procedures.
- Consider that assessment studies on the social and economic impact of development activities may be carried out separately or as an integral part of an EIA. Both types of impact assessments are essential when formulating coastal aquaculture programmes and projects.

- Select an appropriate EIA sequence according to prevalent environmental and development requirements and according to the availability of information and implementation capacities.
- Apply the EIA process to all major aquaculture development proposals. Provide information to applicants/developers on options for mitigatory and adaptive measures to be included in project proposals.
- Incorporate EIA into integrated coastal area management strategies.

3.4 Possible actions to improve environmental management of coastal aquaculture development

General

- Select and implement environmental management options which suit the specific requirements for environmentally acceptable development of aquaculture and other activities in coastal areas.

Environmental protection

- Improve/develop, where required, planning and management processes for protection of coastal environments.

Integrated coastal area management (ICAM)

- Participate in the formulation and implementation of ICAM plans. Provide aquaculture-specificinformation required for ICAM. Indicate goals and set priorities for coastal structure development. Identify coastal resource use conflicts between aquafarmers and other coastal resource users.
- Participate in ICAM zoning activities leading to the designation of coastal resources and space. Indicate coastal areas suitable for aquaculture development possibly based on aquaculture-specific site selection surveys.
- Encourage broad participation and consultation of all coastal resource users and stakeholders in formulation and implementation of ICAM plans.
- Improve cross-sectoral communication and cooperation, possibly by establishing an institutionalized coordination office or cooperation network.
- Help to ensure long-term funding for ICAM, through durable commitment of parties involved in aquaculture and their enforcement of the aquaculture-specific regulations adopted.

Environmental legislation

- Promote flexible and specific legislation in support of aquaculture development.
- Environmental legislation should ensure accessibility and environmental protection of areas and resources required for coastal aquaculture development. Consideration of the variety of aquaculture practices and diversity of environmental settings is essential.
- Help to formulate constructive environmental regulations for coastal aquaculture, where necessary, such as requirements for EIA, waste discharge limits and waste treatment specifications. Apply incentives and deterrents to reduce environmental hazards due to aquaculture activities.
- Adopt and apply the EIFAC/ICES codes of practice on introduction and transfer of marine and freshwater organisms. Movement of species from and to aquaculture sites should be controlled through inspection and certification.
- Coastal aquaculture products should conform with safety standards for seafoods before they are offered for human consumption. Establish quality control measures for aquaculture products. Control the use of aquaculture chemicals such as antibiotics and pesticides.

Planning and management of coastal aquaculture development

- Formulate/improve coastal aquaculture development and management plans.
- Strengthen sectoral capacities for adequate coordination of coastal aquaculture development efforts. Help to ensure continuous and well-targeted support to coastal aquaculture development.
- Cooperate with national development planners to ensure proper integration of coastal aquaculture development objectives and plans into national programmes for economic and agricultural development as well as environmental protection.

Environmental farm management

General

- Promote environmental management at farm or project level. Consult with aquafarmers on specific environmental problems and mitigatory measures adopted. Provide opportunities for exchange of related experiences. Provide information and training to aquafarmers on options for improved environmental farm management.
- Help to improve current aquaculture practices in terms of adequate site selection, efficiency in farm operation and maintenance, and continuous monitoring of biological and hygienic conditions on the farm. Avoid over-stocking.
- Improve formulation and appraisal of coastal aquaculture development projects.

(a) Use of mangrove wetland

- Discourage, where possible, the use of pristine mangrove wetland for aquaculture. Provide instructions governing the use of mangrove wetlands.

(b) Use of feeds and fertilizers

- Improve on-farm feed management. Improve fertilization and feeding strategies. Avoid overuse of fertilizers and feeds. Adapt feeding practices to specific feeding habits and behaviour of the species cultured with due consideration of water quality and water movements in the farming unit. Monitoring of feed application and, where possible, feeding response of cultured stock is essential.
- Continue research efforts on pond metabolism. Encourage development of diets and feeding methods adapted to requirements of semi-intensive farming systems in developing countries.
- Continue efforts to improve physical and nutritional properties of manufactured feeds for use in both warmwater and coldwater aquaculture. Special emphasis should be given to applied research on dietary nutrient requirements of warmwater fish and shrimp species.

(c) Waste management

- Develop low-cost waste treatment technology for use in intensive land-based coastal aquaculture in developing countries.
- Promote integrated polyculture practices to reduce waste loadings.
- Explore ecological and economic feasibility of site rotation.

(d) Chemical usage

- Avoid usage of hazardous chemical substances. Emphasize measures to prevent water-quality

deterioration, disease outbreaks and pests. Detailed on-farm record-keeping on chemical usage is essential.
- Discourage prophylactic use of antibiotics. Reduce environmental risks through minimal and alternating application of drugs.
- Establish, where needed, aquaculture health management services to cover requirements for quarantine, diagnosis, treatment, monitoring and product quality control.
- Control market availability of potentially hazardous chemicals through registration and licensing. Aquafarmers must be provided with comprehensive information on environmental risks and appropriate use of chemicals.

(e) Contamination of aquaculture products
- Promote further development of economically viable methods for depuration/sanitation of contaminated shellfish products. Monitor contaminant levels in shellfish grown in areas subject to pollution and blooms of toxic algae.
- Prepare contingency plans for aquaculture areas threatened by events of harmful algal blooms, and advise aquafarmers on possible countermeasures to reduce risks of damage to cultured stock.
- Promote aquaculture production in unpolluted waters and low-risk areas. Increase public awareness of the safety aspects of consuming seafood. Apply, where unavoidable, temporary bans on harvesting or marketing of contaminated shellfish.

Notes

1. *Source:* Guidelines for the Promotion of Environmental Management of Coastal Aquaculture Development. *FAO Fisheries Technical Paper*, No. 328, Rome, FAO. (in press)
2. *Note:* These notes represent a brief summary of parts of above publication. They represent the views of the author and are not necessarily those of FAO.

Reconciling pressures on the coastal zone

Part I. Fisheries and aquaculture

Foreword

The Committee for Fisheries considered various aspects at the interface between the coastal zone and the fishing and aquaculture interests in its programme of work for 1995 and 1996. At its 77th session in March 1996, the Committee suggested that the conclusions of this work together with the country case studies submitted to the activity be made available to the public. This work is published on the responsibility of the OECD Secretary-General.

Summary and observations

Introduction

When the OECD Committee for Fisheries decided to embark upon a study of the coastal zone, two main parts were identified: coastal resource user conflicts and coastal zone responses to changing fishing possibilities.

The following summarizes the main points which have been drawn from Part I concerning resource user conflicts in the coastal zone. The observations are based on the reports which some member countries submitted and on the discussions during Committee meetings.

The evidence

Background

In pursuing its activity on the coastal zone, the Committee has discussed various aspects of user conflicts based on six country case studies (Canada, United States of America, Norway, Spain, Germany and Japan) provided by member countries. These case studies consider a wide range of problems of resource user conflicts which may be grouped in three major categories:
- Conflicts of interest stemming from allocations to various user groups from a common property resource/fisheries (Canada, United States);
- Conflicts between user groups stemming from the use of the same space/fishing grounds/harbour installation/sea lanes (Norway, Spain);
- Conflicts between user groups due to one user group polluting the sea (Germany, Japan).

The point of departure for most of the discussions in the Committee and in the case studies has been the recognition that user conflicts may lead to coastal zone degradation, which is costly to society. In the case of fisheries, conflicts may be detrimental to fisheries habitats or could have a direct negative impact on the fish stocks.

User groups tend to use the resource without taking into account the possible externalities their practices have on other interested parties in the coastal zone. A parallel is found in the common property nature of fisheries. The total use of the coastal zone may exceed its carrying capacity when either property rights are not assigned, or other appropriate regulatory mechanisms, which internalize the externalities, are not introduced.

A range of conflicts are present in the coastal zone and in the area which it encompasses. Commonplace examples include the conflicting use of space (e.g. interference with commercial vessel lanes by pleasure boats or fishing vessels); pollution (vessel paint TBTs, anti-fouling and its influence on shellfish) and allocations (commercial fishermen versus sports fishermen). Less obvious cases are mineral exploitation, e.g. oil exploration and sand dredging. However, common to all of them is that the conflicts appear because of the lack of property rights in some form or lack of management arrangements for the use of the coastal zone and the allocation of the resources.

The coastal zone and the sea have for long been publicly owned areas with free access and use. The introduction of some form of licensing and/or fees, reflecting the value of the use of the coastal zone and the sea, could be envisaged. It does not appear from the exercise that member countries have instituted any form of tradeable/market based user rights for the coastal zone. Rather, and as shown in the country case studies, regulatory interventions are mostly used.

The various case studies evidence that under certain circumstances it is possible to contain the conflicts, or, through the creation of the appropriate institutions and regulations, diffuse potential conflicts. This has especially been the case in the studies which have dealt with the allocation of fishing or user rights. Success in the cases which have not introduced user rights has been less evident. Some plausible reasons for success or lack of success are developed in the following.

Recognition of the problems

Recognition of the problems in the coastal zone by all interested groups is a major step towards the resolution of

potential conflicts. However, more often than not, the user groups dependent on the coastal zone work as dispersed units making it difficult for them to collaborate and coordinate activities. Hence it is important to have a public authority to analyse the coastal zone in order to develop a comprehensive policy for its development. See in this regard a previous study "Coastal Zone Management: Integrated Policies" (OECD, 1993).

The Canadian case study provides evidence of the benefits of consulting all parties to the conflicts in the coastal zone to identify a common ground for conflict resolution. In Norway local authorities are heavily involved through consultation procedures with the fisheries management and environmental authorities in the planning and use of the coastal zone for aquaculture development. The case study by Norway reports on the development of coastal zone planning with particular emphasis on the accommodation of increased aquaculture activities.

In a report by the Australian Parliament entitled "The Injured Coastline" (April 1991) the point is made that, in spite of having recognized the problems of the coastal zone during various hearings, conferences, inquiries, etc. no comprehensive public action is taken. With a view to remedying this situation, a comprehensive coastal zone inquiry on the management and use of coastal zone resources was undertaken and finalized in 1993; a final report of this work was published by the Australian Resource Assessment Commission in November 1993. The Report concludes, *inter alia*, that a national approach to coastal zone management is essential because no single entity of government can manage the coastal zone alone, that the coastal zone is a significant national issue of public concern, that the socio-economic development of the coast is of utmost importance and that international obligations necessitates coordination between various parts of the Government.

Generation of information

Generation of information by the regulatory agencies on the various conditions in the coastal zone is important for assessing the scale of the problems encountered. Various areas need to be analysed and quantitative and/or qualitative data should be collected on the physical environment, ecosystems, social characteristics of the various user groups, the economic importance of the user groups, etc. Such procedures, however, are costly when followed on a comprehensive basis, partly because the institutions are not present to collect this type of information. Hence, in general, data collection occurs on an ad hoc basis in response to a particular problem.

Also, due to the costs involved, data and information collection tends to be *ex post* to the problems encountered, i.e. conflicts have occurred and relevant information is collected and assessed after the fact. This is typical of most coastal resource user conflicts as identified in the Recommendation of the OECD Council on Integrated Coastal Zone Management (reproduced in "Coastal Zone Management: Integrated Policies", OECD, 1993). In this regard little progress seems to have been achieved since the adoption of the recommendation. There continues to be a need for the integration and harmonization of sectoral policies affecting the coastal zone management and resource usage. The development of indicators for the monitoring of coastal zone activities and processes should be pursued as has been the case with rural indicators.

The discussion in the Committee for Fisheries evidenced that information and data are often lacking and that authorities may take decisions based on limited data. Some member countries (e.g. Norway and Australia) have adopted a more comprehensive approach which involves all levels of decision-making and data collection. The Commission of the European Union undertook a comprehensive Community-wide information and data gathering on the coastal zone in 1992; the objective of this undertaking was to quantify the socio-economic importance of the fishing sector in the coastal zone including an evaluation of the coastal communities' dependence on fisheries.

Continuous monitoring and evaluation

A continuous monitoring and evaluation of the coastal zone and the different economic sectors which coexist there is fundamental. As outlined in the "Strategies to resolve fisheries management problems in the south-east arising from competition between commercial and recreational fishermen" by R.L. Schmied, NMFS, United States, commercial fisheries in the south-eastern United States have changed rapidly during the 1970s; new types of fishing gear, etc. have the potential for adding new dimensions to conflicts. Furthermore, the population in the south-eastern region of the United States grew 45 per cent between 1970 and 1988, adding pressure to the coastal area. Clearly, the monitoring of such developments is of prime importance and underlines the need for establishing relevant data and information bases.

As has been proven for other cases, where the management of a common property resource is being considered, the observance of the rules of the game is best secured by early public participation in the planning and choice of instruments. The Canadian case study has been particularly interesting in this regard. One component in the Canadian "Aboriginal Fisheries Strategy" calls for local participation as the issue of licences is communal and not individual.

The choice of regulatory mechanism also impinges on the user groups' willingness to observe the rules of the game. The Canadian case study clearly shows that when interest groups are approached and consulted, and a common plan developed and agreed upon, conflict resolution, in this particular case due to allocations of fishing rights, can be achieved.

Pollution problems may have serious effects on the fishing industry, including the contamination of fish and fish products. The Japanese case study evidences that discharges into the sea are causing damage to the fishing industry. This is a problem which could also have serious marketing effects on the fishing industry throughout member countries, as demonstrated, for example, by the German nematode experience. In a recent report published by UNESCO in the International Ocean Committee (IOC) Ocean Forum series (Coastal Zone Space: Prelude to Conflict? by Edward D. Goldberg, UNESCO, 1994), reference is made to the rapidly developing tourism industry and the discharges of pathogens into the sea, with possible negative effects on fish and shellfish. The German case study provides evidence on the linkage between dumping harmful substances (e.g. heavy metals) and fish diseases.

Assessment of the costs of user conflicts

Assessment of the costs of user conflicts in member countries is not done on a comprehensive basis. Too often, assessments of the costs involved in not pursuing integrated coastal zone management programmes which could reduce or eliminate the resource user conflicts are not carried out. Such lack of action may also increase the burden at a later stage.

Other

There are other less apparent areas which need to be addressed in the coastal zone, including proper institutional mechanisms, the type of regulatory framework for conflict resolution, i.e. administrative regulation versus market mechanisms, and the level of decision-making.

Part II. Coastal zone responses to changing fishing possibilities

Introduction

Coastal zone responses to changing fishing possibilities was the subject for the Committee for Fisheries' second part of its undertaking on coastal zone management. Three country case studies (Canada, Japan and Norway) were presented, and a number of member countries contributed information on coastal zone activities in their country.

The coastal zone attracts an increasing number of people thus increasing the competition for space in the coastal zone and changes the relative importance between the coastal zone, cities and rural areas with regard to population and economic activity. In some countries, e.g. the United States, the coastal zone plays a particularly important role in the "territorial equation" because the number of people living there is important; the coastal zone accounts for 20 per cent of the land but contains 50 per cent of the population (and increasing).

The coastal zone is the home for a range of activities and is central to the fishing activity. The key issue in this Part II of the coastal zone activity is to highlight the linkages between the fishing industry and the other activities which take place in the coastal zone, i.e. between the fishing industry economy and the coastal zone economy at large and to study policy responses to changing fisheries conditions in the coastal zone.

The coastal zone has an important role in providing alternative potential employment opportunities and sources of income for a fishing industry characterized by loss of fishing possibilities, low incomes and continuous restructuring, including contraction of fleets and a reduction in the number of fishermen.

It has often been stated that when the fishing sector is undergoing restructuring, an important element is to provide laid off fishermen with alternatives to fishing in the coastal zone. In fact, the success of changes in the fishing sector will, among other things, depend on how easy it is to get fishermen into other occupations. The OECD's Committee for Fisheries, because of the characteristics of the fishing industry, has fruitfully contributed to a better understanding of linkages between the fishing industry and the coastal zone by identifying policy instruments which may help fishermen find alternative job opportunities. In fact, several of the Committee's studies in recent years, e.g. on structural adjustment, management and economic assistance, have contributed elements which have clarified these linkages and provided examples of policy instruments in use.

In many cases, a critical element in management plans, which is often overlooked, is what to do with displaced labour. The low opportunity costs of most fishermen reflect the fact that they have few employment alternatives outside the fishing sector, hence their reluctance to leave the fishing sector.

The evidence

General comments

Changing fishing possibilities may come around for numerous reasons. The most cited examples is stock depletion, but introduction of management measures such as licence limitation, international trawling quotas, closed fishing areas and closed fishing seasons also impact directly on the fishing sector. While changing fishing possibilities may be a natural part of an industry which fluctuates, it does create pressure on the coastal zone economy, including demands for alternative job opportunities and may influence the overall economy of the area.

The country case studies submitted to the structural adjustment activity and the Review of Fisheries show that most member countries are in a constant struggle to adapt the fishing industry to available resources. Common for most member countries is that actions to adjust come late and consequently the adjustment burden becomes more difficult. It should be recalled that there may be a "natural" efficiency increase in fisheries due to technological innovations and that such developments may displace labour. In addition, late or slow adjustment of fleets to available resources may have serious socio-economic impacts as well as resulting in low average incomes.

It is purposeful to distinguish between two main types of fishing communities in an OECD-wide context, i.e. the home bases for fisheries in developed areas where employment alternatives are available and where some infrastructure is present (harbour facilities, processing and an active labour market) and remote fishing communities with no (or few) alternative employment opportunities and poor infrastructure.

In the OECD countries the lion's share of landings tends to concentrate around important port infrastructure. Modern fishing technology demands that services (ice, repairs) can be provided on the spot, i.e. are available in the harbours. Hence, the activity of the segments of the fishing industry providing the largest share of supplies occurs in areas where a certain infrastructure development is present and where the fishing sector is one of many activities.

As discussed in Part I of this report, the developed coastal community is characterized by conflicts with other sectors of the economy (tourism, marinas, pleasure boating), and by one of encroachment. In such coastal zone areas the contribution of the fishing industry to the local economy is not big. However, it is from such areas that the largest supplies of fish are coming.

Certain coastal areas in the OECD, although they may be small and isolated, are characterized by heavy dependence on fishing. The material made available to the Secretariat includes one comprehensive study on coastal zones dependency on fishing commissioned by the EU Commission. Covering the European Union, the report ("Regional, Socio-Economic Studies in the Fisheries Sector", EU 1993) identifies fishing dependent communities in various ways according to the country concerned. Within the European Union, 20 zones have been identified as heavily dependent on fisheries. Heavy fisheries dependent zones are located in Scotland, on the south and the north-west Atlantic coast of Spain and the east coast of Italy. Other examples, outside the European Union, include remote coastal areas of Norway and the Atlantic coast of Canada.

A problem encountered in remote fisheries dependent areas is a thinning of the population towards a "critical mass" level, where normal societal infrastructures such as schools are at risk and/or where small/medium-sized businesses cannot operate profitably. Furthermore, a "thinning" of the fisheries population makes the age structure skewed (e.g. Japan). Such developments further contribute to the problems of alternative employment opportunities.

Evidence provided by EU country case studies

Focusing on job creation initiatives as an adjustment help in the coastal zone context, the study undertaken by the European Union entitled "Regional, Socio-Economic Studies in the Fisheries Sector" (EU, 1993) provides the following evidence.

In the Netherlands there is no sector-specific re-employment policy. There is a general re-employment scheme with a focus on re-educating unemployed to jobs in other sectors. The study concedes that fishing communities live isolated from other sectors of the economy, thus making the general policies inefficient *vis-à-vis* this particular sector.

In the United Kingdom (Scotland and Northern Ireland) fishermen, due to the payment structure with shares, are regarded as self-employed. As such fishermen do not receive any unemployment benefits when laid off definitely; this is considered a clear disincentive to reduce capacity through decommissioning. The report suggests using the same type of schemes as were used when restructuring the steel and coal industry. This included the setting up of job shops helping unemployed to find prospective employers, writing applications, etc. A couple of retraining projects have been undertaken, where the success has been largely a function of the degree to which previous skills are relevant to new jobs. The aquaculture industry has not been seen as a viable alternative job solution in the short to medium term.

On the contrary, in Greece aquaculture is seen as a viable alternative to fisheries and with a potentially rapidly developing sector (sea bass and bream) where retired fishermen should be able to find new jobs. Difficulties have been encountered withdrawing fishermen from fishing, unless through retirement.

In Ireland a survey of displaced fishermen showed that only a limited number of them could find work in non-fishery related activity within the coastal zone they come from. The fishing sector has potential for growth but lacks capital and the necessary qualifications for a modern fishing sector. There is no reconversion scheme specifically for fishermen.

The study on Denmark identifies a number of factors which are important in easing the reconversion of fishermen towards alternative jobs. Besides the presence of alternative industries within or outside the local community an important factor is the mobility (geographical and professional) of the affected fishermen. The study concludes that the coastal communities likely to be most affected by a reduction in fishing possibilities are the ones where these factors are not present or present at low levels. Hence, such communities need help in the adjustment process.

On the EU level, the European Regional Development Fund and the European Social Fund may co-finance (with member States) infrastructure developments which may be needed for alternative industries, training costs, etc.

Evidence provided to the activity "Restructuring the fishing industry"

Using the information from the Committee's undertaking on "Restructuring the Fishing Industry", member countries give varied impressions as to the difficulty of alternative employment in the coastal zone.

In Australia it is recognized that short-term socially adverse consequences will be the result of a reduction in fishing capacity. However, if adjustment takes a long time, experienced fishermen are likely to retain employment. Certain regional communities that rely heavily on the fishing industry will be adversely affected.

In Finland employment in sea fishery has been decreasing for a number of years. This development is not entirely due to the stock situation, which with regard to herring and sprat is very good in the Baltic. The reason for the decline is mostly due to larger and more profitable units. Reared salmon stock is also abundant, but because of scarce wild salmon stock, this fishery is heavily regulated resulting in loss of employment of some fishermen. Aquaculture is regionally important providing employment opportunities and besides the main activity which in Finland is production of rainbow trout for consumption, it also contributes both to coastal and freshwater areas by enhancement of fish stocks and hence to fishing and tourism.

In Japan the fishing industry contribution to the overall economy cannot be ignored, creating employment for 1.7 million people. The Japanese study reports that from a regional point of view, and in particular where alternative employment is limited, the role of the fishing industry is crucial. The same applies to the home bases of the distant water fishing industry, which sustains dynamism to the local economy, as this part of the fleet requires large investments and advanced production systems.

Large decreases in the number of persons engaged in fisheries in Japanese local communities dependent on distant water fisheries were experienced through the 1980s. It is reported that former long-distance fishermen had difficulties in finding employment in the fishing industry; most changed occupation and moved to urban industries. The Japanese Government took special measures towards the long-distance fleet fishermen reductions which included circulation of vacancy notices, vocational retraining and unemployment insurance. It is, however, noted that former fishermen tend to be geographically and occupationally immobile and that new job alternatives outside the fishing industry may not be personally satisfying.

While the number of fishermen has decreased considerably in Norway, the number of inhabitants in coastal communities dependent on fishing has only changed slightly. An active fishing industry, although not by sustaining artificial high-capacity levels, is considered important to sustain coastal communities. Through contributing to stable and reliable supplies of fish, aquaculture may contribute to job and income stabilization in the traditional fish-processing industry.

Norwegian policy aims at maintaining a dispersed settlement in coastal areas. Stable and guaranteed incomes, through measures such as unemployment benefits and retirement pensions are secured by the Government. Furthermore, recruitment to the fishing industry is an important longer-term objective which needs a well-established and functioning coastal community.

Conclusions

Remote coastal fishing communities in some OECD member countries are particularly dependent on the fishing economy, although it is often difficult to measure the degree. The majority of landings take place outside areas significantly dependent on fisheries and the linkage between the boats' landing and individual communities is not monitored. Consequently, if landings alone are measured it is possible to underestimate the economic contribution fisheries make to the port of origin of the fishermen or overestimate the availability of alternative economic opportunities.

Disregarding the reasons for adjustment, many member countries pay particular attention to the fact that fishing communities are very slow to adjust to new realities. The combination of family supported fishing ventures, low education levels, low levels of information, the freedom of fishing in most cases without paying for the common property, the chance of getting instantly rich through a big catch and remoteness, make fishing communities a special case. Traditional policy measures towards labour adjustment and reorientation have little if any effect in fishing communities.

During the first round of discussion in the Committee for Fisheries on this part of the coastal zone activity, it was evident that pursuing a more encompassing approach in managing fisheries is necessary; while fish stocks need management, fisheries deal with people as well, and solving fisheries problems need to address issues related to the fishermen, the fishing communities and the development prospects for the coastal zone. There are important human and socio-economic dimensions which have to be addressed if fisheries policies are to be successful.

Maintenance of community life has been mentioned by some delegates as an important societal goal although market economics may not prescribe such goals as efficient. Government intervention through allocation of resources and the use of administrative means (e.g. allocation of fishing quotas) is therefore necessary. In the meantime, a more global, encompassing and integrated approach to coastal zone management is needed if such objectives are to be successfully implemented.

Against the background of continuous overfishing and the need for restructuring, work towards improving the understanding of the social aspects of fishing communities is even more important and urgent. The Committee for Fisheries' activity on living marine resource management has identified effects of management policies and measures, while the economic assistance activity has identified, *inter alia*, the linkages between assistance policies and management as well as the effects of certain assistance measures. Another building block for a sound coastal zone fisheries industry would be the identification of relevant and workable labour adjustment programmes which are efficient in the context of the fishing industry.

In so far as the experience of other OECD member countries concurs with the above conclusions, there is need for further developing reflections on job creation in the coastal fisheries community context. Traditional employment policy responses are not working efficiently in the context of the fishing industry and a more appropriate mix of measures which better target the particularities of the fishing industry will have to be advanced. To this end the OECD's Committee for Fisheries will consider social aspects of fishing dependent communities as a follow-up to its undertaking on the coastal zones. (Extracted from *OECD: Reconciling Pressures on the Coastal Zone—Fisheries and Aquaculture*. The report is available from the OECD, or booksellers. OECD, 2 rue André-Pascal, 75775 Paris, Cedex 16 France)

Environmental impact of seabed mining technology

Prepared for the Workshop on Marine Industrial Technology for the development of Marine Non-Living Resources, 27-30 September 1993, Madras, India.

Introduction

The study of the impact of deep seabed mining on the oceanic ecosystem involves three components:

(a) Establishing environmental baselines of the selected parameters likely to be encountered during module mining (environmental characteristics);

(b) Potential environmental effects of nodule mining and developing prediction capabilities; and

(c) Developing appropriate environmental guidelines.

It may be appreciated that it is not scientifically and economically possible to develop very detailed baseline information on the ecology of all offshore environments in a relatively short period. Accordingly, the consequences of a variety of mining scenarios cannot be precisely predicted. In the very near future, therefore, environmental impact statements will presumably be prepared to identify site specific problems prior to the commencement of mining operations.

Environmental baseline information

The pre-mining environmental characteristics will serve as a database for measuring environmental consequences associated with mining. Environmental parameters that are specifically relevant to the mining activities and need systematic studies over a period of time and space is summarized in the following table. These parameters represent selected characteristics of the upper water column and the lower column including the seafloor. These are briefly reviewed.

Parameters of upper water column

Characteristics of the surface waters including seasonal variations are important for modelling surface plume dispersion and inference on potential biological impacts.

Nutrients

Certain nutrients (phosphates and nitrates) in the upper water layer affect the marine food chain by controlling the abundance and composition of the phytoplankton. The nutrient levels therefore constitute an important information due to the critical importance of the phytoplankton to the oceanic food chain and the ecosystem.

Endangered species

In view of the possibility of endangered species occurring in the deep sea exploration/mining area or along the ship routes, it is pertinent to make observations on identification of the species, location of observation, number of individuals—males, females etc.

Salinity, temperature and density

Salinity and temperature values and their spatial and temporal variations are relevant to the location of the thermocline and pycnocline. The change in density due to temperature differences in the pycnocline is important to its effects on the settling rates of discharged particulates.

Currents

The velocity and the variability in the upper layer currents effect the concentration, dispersion and settling of surface plume and hence relevant.

Specific environmental parameters relevant to assessment of deep seabed mining

Affected Environment	Relevant Parameters
Upper Water Column	Endangered species
	Temperature
	Density
	Currents
	Currents and shear
	Vertical light
	Suspended particulate matter
	Dispersion
	In situ settling velocity
	Zooplankton and trace metals
	Fish larvae behaviour
Lower Water Column	Currents
	Suspended particulate matter
	Dispersion
	Benthos
	Sediment
	Topography
	In situ settling velocity
	Benthic impact and recovery
	Blanketing
	Mining efficiency

Lower water column and seafloor

Lower water column and seafloor characteristics are directly relevant to benthic impact. The relevant parameters include the following:

Currents

Like in the upper layer, the bottom current measurements are input for the benthic plume model.

Suspended particulate matter (SPM)

The concentration and variability of SPM concentration in the bottom water is relevant to understanding the dispersion pattern of the benthic plume and in establishing the range of variability of SPM experienced by the benthic organisms.

Benthos

For predicting the consequences of mining on the benthos, it is necessary to know the species, diversity, density, biomass and the relation to topography of the organisms present. Such information obtained from photos, box cores, videotape, etc. will constitute the basic information.

Sediment

Size distribution, density and shape of the sediment are pertinent information since they effect the dispersion pattern and settling rates of the benthic plume.

Potential environmental effects and prediction capabilities

Deep-sea environment

In the deep sea, the abundance of animal life decreases with increasing depth and distance from land. Deep sea animals are predominantly restricted to the surface of the seafloor and upper few inches of sea bottom. It appears that the species, particularly catalogued at present and the information on their life cycles is inadequate. The density of animals is low but diversity is considered to be high. In these regions, the low total number of animals is thought to reflect the restricted food supply, which comes from either residues raining into the deep sea from above or from *in situ* production.

Deep-sea mining studies

All estimates and inferences regarding environmental impacts of deep sea mining draw heavily on information from the Deep Ocean Mining environmental study (DOMES) funded by the National Oceanographaic Atmospheric Agency (NOAA). Until now, this seems to be the only systematic long-term research programme conducted in very deep water. Extrapolations from these studies to other ocean sites rest on the assumption that, in general, the abyssal ocean is a much more homogeneous environment than shallow water environments.

The mining scenario presumed removal of nodules from the deep seabed by means of a collector driven along the seabed at about two miles per hour. Animals on the seafloor directly in the mining path or nearby would be disturbed by the collector and the subsequent sediment plume. In addition, when the nodules reached the mining ships, the remaining residue consisting of bottom water, sediments and nodule fragments would be discharged over the side of the ship, resulting in a surface discharge plume that might also cause adverse impact.

Summary of possible impacts

The study carried out under the DOMES programme concluded that while there were 20 to 30 possible negative impacts from deep sea mining, only three were of sufficient concern to be investigated.

The first of the three important impacts occurs at the seabed. First, the collection equipment will probably destroy benthic biota, an impact which appears to be both adverse and unavoidable. The degree of disturbance depends upon the kinds of equipment used and the intensity of mining. Most benthic animals in this region appear to be tiny detritus feeders that live in the upper centimetre of sediment and are fed by organic material that falls from upper waters. In the worst scenario, the benthic biota in a very small part of the mining areas may be killed due to impacts from first generation mining activities. Although recolonization is likely to occur after mining, the time period required is not known. No effect on the water column food chain is expected.

The second important type of impact identified is due to a benthic plume or "rain of fines" away from the collector which may affect seabed animals outside the actual mining tract through smothering and interference with feeding. Suspended sediment concentrations decrease rapidly, but the plume can extend tens of kilometres from

the collector and last several weeks after mining stops. No effect on the food chain in the water column is expected due to the rapid dilution of the plume. However, mining may interfere with the food supply for the bottom-feeding animals and clog the respiratory surface of the filters.

The third impact identified as significant is due to the surface plume. Under a possible scenario, a 5,500 TDP mining ship may discharge about 2,000 tons of solids and about 3 million cubic feet of water per day. The resulting surface discharge plume may extend about 40 to 60 miles with a width of 15-20 miles and will continue to be detectable for three to four days following discharge. Such plumes may affect the larvae of the fish, such as tuna, which spawn in the open ocean. The turbidity in the water column will decrease light available for photosynthesis but will not severely affect the phytoplankton populations. The effect may be well within the realm of normal light level fluctuations.

The post-DOMES research suggests that the problem of surface plume may not be as serious as was considered before due to rapid dilution and dissipation. However, another potential effect has been identified—that of thermal shock to plankton and fish larvae in the immediate vicinity of the cold water discharge, at the surface of cold deep water. However, except for mortality of some tuna and billfish larvae in the immediate vicinity of the cold water discharge, adverse effects appear to be minimal.

Impact predictions

With the environmental baseline data generated, theoretical models to predict the impact of mining activities will need to be developed which may be refined based on the available experimental data on environmental impact of seabed mining. The most important area of modelling appears to be plume dispersion models covering the surface plumes as well as the benthic plumes. These models should have the capabilities to be used as a basis to assess impacts for site specific situations. The model will be used for predicting the volume of the mixing zone within which certain unavoidable effects may occur, such as zooplankton mortality from the amount of solids in suspension following discharge to the ocean surface, and to estimate approximately the volume of ocean within which impacts might occur. The model so developed must evolve to incorporate what is learned in the continued data collection programme during exploration as well as test mining operations. In fact the environmental monitoring during even exploration and test mining phases will need to be carried out to provide relevant data for developing effective predictive models. These models, however, will continue to be updated through future research and monitoring especially of full scale mining system tests.

Environmental guidelines

It will be required to develop an environmental guidelines document including environment impact statements prior to commencement of mining operations or prior to submission of a work plan. Such a document will be based on detailed environmental baseline information and suitable predictive models for environmental impact.

Reference areas

Before mining commences in the deep sea, it will be required to identify two reference areas which should be maintained for sampling during the operations. One such area will be sufficiently removed from the impact area to serve as a control. This is referred to as the "preservation reference zones" in which no mining shall occur to assess any changes in the flora and fauna of the marine environment. The second area may be adjacent to the mining area called "impact reference zones" which will be used for assessing the effects of mining operations in the area.

Recent German studies

While systematic studies on a long-term basis on the environmental impact of deep seabed mining were earlier carried out by NOAA under the DOMES programme, some recent studies and programmes of German companies and institutes supported by the Government are of special interest. THETIS Technologie GmbH supported by the German Ministry for Research and Technology have initiated two-pronged studies in this regard. The basic approach involves design and development of seabed mining technology in general and of the collector subsystem, in particular, incorporating environmental friendly features. Studies are concentrated on controls, pick-up efficiency with minimum cutting depth, optimization of traction and trafficability and material selection such that the resultant self-propelled, hybrid collector subsystem is environmentally acceptable. In the second set of studies, experiments have been designed to study on a long-term basis the nature and extent of impacts of the operations similar to the deep seabed mining.

Japanese studies

The studies undertaken by the Japanese agencies involved in seabed mining and related developments include development of simulation models for assessment of the impact of mining activities on the oceanic environment including the benthic ecosystem. These agencies have commenced an environmental impact survey to evaluate the simulation models through indoor experiments, field experiments and observations.

B. INDUSTRY NEWS

Platform removal system developed

Two Statoil engineers have developed a dedicated system for removal of steel platforms without use of a heavy-lift crane. The deck/topside and jacket of each platform are removed intact and floated to shore, where they can be disassembled at costs of less than 15 per cent of that experienced offshore. The engineers have developed patentable lifting solutions to achieve the removals:

- **U-shaped vessel:** A wide vessel with a removable inner hull slides under and around the jacket legs and commences to ballast up under the deck. The jacket legs are cut under the deck and the load transferred to the vessel. Ballast tanks are used to correct for displaced centre of gravity. The vessel then takes the deck to shore for disassembly.
- **Jacket lifter:** After the shallow cross members are cut, a large supply vessel equipped with deck winches slips between the platform legs. The jacket piles are cut at the seabed and the jacket is lifted beneath the vessel by the winches and towed to shore or deep water. This system depends upon sufficient water depth to move the suspended jacket.
- **Shearlegs plus submersible:** For smaller steel platforms, two small pieces of equipment—a floating shearlegs crane and a submersible barge with steel shafts installed on deck—can be assembled offshore for lifting out topsides and jackets economically. The submersible is ballasted down until the shearlegs can be floated on and attached, thus increasing the lift capacity and acting like a semisubmersible hull. (Source: *Offshore*, February 1996)

Acceleration fins boost ship speeds by over 10 per cent

Real Models Co., Ltd. has established technology for attaching several acceleration fins to a ship hull, by which the cruising speed is increased by over 10 per cent, and the wave resistance and directivity improved. Patents for the technology have already been acquired in Japan and in six other countries.

The technology is simple and essentially consists of fitting fins on the ship hull, by which the hull wave resistance is decreased considerably. The company designs the fin shape and fitting positions, after which the system is procured through ship equipment manufacturers. The system is available for small to large vessels and displays its effects especially with vessels requiring fast cruising speeds. It can be fitted onto newly built ships as well as existing vessels with ease.

Fitting these acceleration fins repels the sea current from the hull and generates a layer of air between the hull and sea current, and prevents the growth of boundary laminar flows, so that the wave resistance between the water current and ship hull is decreased substantially. The fins are triangular, made of the same material as that of the hull, and fitted at several places above and below the draught line. As a result, the propulsion resistance is reduced by 20 per cent, equivalent to an improvement of over 30 per cent in terms of horsepower, and the speed is increased by over 10 per cent, as corroborated through the use of these fins on fishing ships.

Vessel rolling and pitching in waves is also decreased, which translates into fuel conservation. When the fin system was installed on a fishing vessel in the Ohara fishing port in Chiba Prefecture, the running time was shortened by about one hour in a shuttling operation usually requiring 10 hours. The fin system is applicable to all kinds of vessels from small boats to large container and high-speed cargo vessels, and the effect will be the most pronounced when applied to vessels required to cruise at high speeds.

More information is available from Real Models Co., Ltd., Public Relations Dept., 9-34-14, Kameido, Kouto-ku, Tokyo 136 (Tel: +81-3-3638-3760). (Source: *JETRO*, February 1996)

ABB supervises Judy control

Phillips UK's Judy platform, installed in 1995, features an A5 million integrated control, monitoring and safety system—one of the first on a UK production installation, according to supplier ABB Industrial Systems.

The package comprises a distributed control system based on the ABB Master Process Control system. Main equipment includes Masterpiece controllers with MasterView operator display stations; SuperView management reporting system; and MasterSafeguard emergency shutdown and fire and gas detection systems.

The latter supports extended self-testing and fault-handling routines of the processing units (watchdogs, execution supervision) and process interface connections (status and unit errors, individual status and output signal readback).

Equipment is distributed at Phillips' Ekofisk platform and onshore at Aberdeen, as well as on the Judy platform. The control system, designed with main contractor Kvaerner H&G Offshore, features a novel three-way data routing system to ensure that critical gas production data is accurately transmitted to the CATS gas reception terminal on Teesside. (Source: *Offshore*, February 1996)

Wireline guide provides tips on deep well service

New literature from Sandvik Steel promotes the use of its special alloyed stainless steel wirelines for severe and corrosive downhole conditions: these are commonly being encountered as production increases from wells of greater depth.

The wireline range includes slick lines and wire for manufacture of logging cable. Wire comes in several grades suited for sweet and sour gas wells, and in a wide range of diameters from 1.83 mm (0.072 in.) to 3.18 mm (0.125 in.). It is supplied on metallic spools in continuous lengths up to 9,000 m (30,000 ft), without welded joints.

Sandvik's six-page brochure and material selection guide specifies seven likely well conditions, along with the recommended wire grade. Levels of pressure, temperature, carbon dioxide, chlorides and hydrogen sulphide are defined.

Each steel grade's key features are listed, such as corrosion resistance and aptitude for sweet and sour service, along with chemical composition, tensile strength and physical properties. Breaking load for each grade is calculated from the wire's tensile strength, and wire weight for each size is also presented.

Also included is a formula for calculating wireline stretch under load and a table for estimating the height of lost line should wireline failure occur. There is also advice on handling wirelines in such a way as to extend service life.

For more information contact Sandvik Steel UK (Fax: +44 121 428 2363). Alternatively, Sandvik Steel in Sweden (Fax: +46 26 25 2770). (Source: *Offshore*, March 1996)

Electronic fish fat detector

The Torry fish fat meter designed by scientists at Aberdeen's Food Science Laboratory (Scotland, UK) to solve the fat problem in salmon and trout was launched recently. The device uses microwave technology to give an instant reading of the fat content without damaging the fish. The fat meter allows the fish farmer to monitor and change the diet of growing fish.

The hand-held portable meter replaces the traditional method of measuring fat level, which involved killing the trout or salmon and sending samples for laboratory analysis. The meter is held against the surface of the fish, and at the push of a button, the fat content is displayed on a liquid crystal screen.

Manufactured by Distell Industries of Fauldhouse, West Lothian, the meter was developed by scientists at the Torry research station. Distell has also produced a meat fat meter, using similar technology, which gives an instant analysis of the fat content of various kinds of meat. According to the company, the meter gives shop owners and trading standards officers an accurate reading of the fat content of meat and meat products on supermarket shelves. (Source: *INFOFISH International*, March 1996)

New electronic fish chart plotting device introduced

A new version of the successful Fish Master chart plotter has been launched by Racal Decca Marine Ltd. (New Malden, Surrey, UK) to meet the needs of long-range and deep-sea fishing vessels. The new Fish Master 2 contains a range of valuable new software benefits designed to help profitable fishing and simplify long-distance voyage planning.

Its ability to show great circle or rhumb line route legs is a significant benefit when planning long voyages. The great circle route is shown as a curve on the chart display and the difference in distance between it and the rhumb line can be calculated automatically. Other benefits include the ability to input or correct waypoints on screen and to accept them and routes from external sources such as a GPS receiver. Optimum use of engines, and therefore fuel, is also assisted through the unit's ability to calculate estimated time of arrival and required speed.

When linked to a suitable radar, the new device will display up to 40 tracked targets against the background of the chart and/or the user-generated map, providing the operator with a greater appreciation of what is happening around his own ship, including the activities of other fishermen. Tracked target symbols are displayed in the colour of their navigational light, which would be visible, while stationary or very slow moving vessels are shown as magenta. (Source: *Sea Technology*, March 1996)

Environmental/engineering firm develops ocean management plan

Dames & Moore (Los Angeles, CA) has been charged with developing an ocean management plan for future use of Kaho'olawe Island—one of the eight major Hawaiian Islands. The plan will cover a two-mile radius of ocean around the island, which contains some threatened or endangered species such as the Hawaiian monk seal, green sea turtles and humpback whales.

Dames & Moore engineers are conducting interviews with area stakeholders, analysing ocean resources, documenting conditions of fisheries resources, and estimating sustainable yields in an attempt to restore marine ecosystems. The plan will also address the presence of unexploded ordnance in the waters surrounding the island—a major public safety issue. (Source: *Sea Technology*, March 1996)

Deep-water, high-resolution, side-scan sonar system purchased

EdgeTech (Milford, MA) delivered a DF-1000 digital side-scan sonar system to American Underwater Search and Survey Ltd. (Cataumet, MA) for use for high-resolution, deep-water search. The system is able to produce high-resolution sonargrams over long cables. Using a single co-axis towcable for power and data allows for a low-profile towcable that will reduce the winch requirements and provide less drag.

The system digitizes four channels of sonar (100 kHz and 500 kHz, port and starboard) and along with the heading and other digital data is sent via a high-speed up-link to the digital control unit (DCU). The topside DCU controls a number of parameters including voltage, range, data fusion start, etc. Outputs allow the user to interface a host of topside processors to the DF-1000.

Applications for the side-scan system include hydrographic surveys, geological surveys, cable and pipeline surveys, search and recovery, site selection, pre- and post-dredging surveys, location of seafloor hazards, and mine hunting. The DF-1000 is easily adapted for installation on remotely-operated vehicles (ROVs) and autonomous underwater vehicles (AUVs). (Source: *Sea Technology*, March 1996)

Daewoo develops unmanned deep-sea vehicle

Daewoo Heavy Industries Ltd. has successfully developed an unmanned deep-sea vehicle which can cover down to 6,000 m in cooperation with a Russian research institute. The development required three years of research efforts. The Ship and Ocean R&D Institute of Daewoo Heavy Industries and the Institute for the Marine Technology Problems (IMPT) of Russia participated in the development of the torpedo-shaped autonomous underwater vehicle (AUV). The AUV, 3.8 m long and 0.7 m in diameter, would conduct deep-sea mineral exploration, search and survey for sunken bodies and scientific activities like oceanographic data measurements at a speed of three knots. The vehicle, propelled by four end thrusters, can submerge to a 6,000 m depth without a tether line to the mother ship. It carries out programmed missions by recording data on the hard memory board of internal personal computers, the company said. (Source: *Newsreview*, 2 March 1996)

"Frozen" flowline reduces strain on pipe wall during tow-out

A new method of installing subsea flowlines has been developed by a Swedish inventor which is claimed to be both cost-effective and safe. It has been given the name of the wIce Tug method. The flowline is assembled on the shore, and as each length is added, floated into the sea.

When it has been fully assembled, a freezing tube is placed inside it along its whole length, together with a towing wire and ice expansion compensator. Both ends are plugged and the water inside the pipe is frozen. In this state the flowline can be easily towed by tugboat at a controlled depth. On reaching the installation site, it is lowered into the position on the seabed, the plugs are removed and the ice is allowed to melt. When the ice has melted, the freezing tube, towing wire and ice compensator are drawn out and returned to the shore for re-use. The operation is straightforward and safe.

While under tow, the ice inside the pipe takes some of the dragging forces, reducing the strain on the pipe-wall and preventing it from buckling. The operation can be carried out even in adverse weather conditions, thus giving a large window when activity can take place.

For more information contact Marknadsbyran (Fax: +46 114 446). (Source: *Offshore*, March 1996)

PRC operator orders Austal 40 m catamaran

Austal Ships has released details of the contract it received towards the end of 1995 to supply another 40 m catamaran to an operator in the People's Republic of China.

Due to be delivered in June, the vessel is to be operated by Zeng Cheng City Port Construction Development, a company based in the south of Guangdong Province, on a new route to Hong Kong.

Length overall will be 40.1 m, moulded beam will be 10.0 m, and the operator has specified a layout for 206 passengers in the main deck saloon and 62 passengers in the upper saloon.

Powered by twin MTU 16V 396 TE74L diesels and KaMeWa 71S waterjets, the catamaran will have a service speed of 33.5 knots. (Source: *Fast Ferry International*, March 1996)

Telephone's extended power range boosts hopes for divers cast adrift

An advanced high-power, hydro-acoustic telephone for emergency underwater communications will soon become available to the offshore market. The technology is being developed by Stocktronics, a Stockholm-based specialist in underwater communications, whose deep diver communications system is the only one currently able to meet the specifications laid down by Norwegian oil companies Statoil, Norsk Hydro and Saga.

These are the same three companies which, through Norway's EUDT/OMEGA research programme, have funded part of the development of the hydro-acoustic telephone. This is intended to provide a lifeline in cases where a diving bell has been lost, along with its communications cable.

The key problem to overcome is the immense cavitation noise caused by mother ships and other vessels hovering on the surface in DP mode. Existing hydro-acoustic telephone systems can only achieve communication over limited ranges of 20-30 m.

Stocktronics' breakthrough has come with the development of a method for connecting the piezo-ceramic rings in the system in an array-shading manner which gives high power, but does not restrict the acoustic radiation pattern, as happens with existing systems.

The system has been tested inshore in the presence of Swedish Navy observers at distances of 100, 1,000 and 5,000 m using an early prototype transducer. The unit provided clear speech communications at all three distances, though some background noise was audible at 5,000 m.

High-power amplifier

The system will be fully modularized and will include the Stocktronics Frequency Domain Helium-Speech (FDHS) Unscrambler as an optional extra. A working system should be available by year-end.

In addition to its use in emergency situations, the company expects the civilian and military submarine market to be interested in the hydro-acoustic telephone for normal operations. In this case, the FDHS Unscrambler could be adapted to encrypt speech as a protection against the interception of communications by third parties.

For more information contact Stocktronics (Fax: +46 833 0988). (Source: *Offshore*, March 1996)

Automated ship painter developed

Shipbuilder Hyundai Heavy Industries has developed an automated overhead spray painter for ships. The machine automatically paints in accordance with data provided on the size and type of ship. It is also capable of painting ship bottoms thus saving on labour costs, according to the company. (Source: *Korean Business Review*, March 1996)

Navibulgar orders Global Maritime Distress and Safety System (GMDSS) station

The Bulgarian national shipping company, Navibulgar, has placed a major order with the UK's Marine Technology International Ltd. (MTIL) for the UK firm's Solas Lifeline GMDSS station.

Navibulgar's order, worth more than $1.75 million, will see Solas Lifeline equipment fitted aboard 30 of the company's vessels. MTIL is to set up a dedicated project team to tackle the logistical complexities of coordinating the installations with minimal disruption to sailing schedules. It will establish a service base in Bulgaria to train Navibulgar's own senior engineers to install and maintain the equipment.

The Solas Lifeline comes in four electronic configurations. The Navibulgar sets will comprise of Inmarsat-C and MTIL's new 400W radiotelephone and telex system, complete with DSC systems. (Source: *Ocean Voice*, April 1996)

Guide to differential GPS stations

A comprehensive guide to all the world's differential GPS stations has been published by Philips Navigation.

The guide lists a host of important details about each station, such as the precise location, radio frequency, baud rate, identity and reference codes. More than 150 established and planned DGPS reference stations in 24 countries are listed in the guide, which Philips claims is the only one of its kind. The guide is available free of charge from Philips or Philips distributors. (Source: *Ocean Voice*, April 1996)

Firms to launch lightweight portable telephones

Magellan and Globesat are two of the latest firms to launch lightweight portable telephones that use the Inmarsat-M satellite system.

Magellan's Microcom-M is described as a "lap-top" unit and the company claims that, at just 2.5 kg it is the lightest on the market.

Globesat's new telephone, called Downsized-M, comes with an optional cordless handset that allows users a wireless interface to the unit for distances of up to 1 km.

Although neither set is approved for shipboard installation, these so-called "land mobile" satellite telephones are becoming increasingly popular among shore-based staff in the shipping industry for whom global travel is an integral part of working life. (Source: *Ocean Voice*, April 1996)

New version of Orion weather routing software released

A new version of the popular Orion weather routing software has been released by WNI Oceanroutes.

Orion allows users to create and compare routes to select the one that best suits voyage requirements and vessel characteristics, taking into account crew safety, cargo requirements, voyage time and fuel consumption.

The new version, designated 2.2, features a number of improvements. The speed reduction algorithm, which is used to compute the vessel's ideal speed in given weather conditions, can now be tailored by means of manual calibration to an individual ship.

And two new kinds of weather data, satellite imagery and text forecasts, are now available. These data can be selected for any part of the world and down-loaded to the system via Inmarsat. (Source: *Ocean Voice*, April 1996)

Approval for electronic chart display received

PC Maritime claims to be the first company in the world to receive approval from the UK Hydrographic Office (HO) for an electronic chart display compatible with the HO's "Arcs" electronic charts.

The company says its Navmaster system is the first to pass the HO's tests for system compatibility. Navmaster supports both raster-scan (like Arcs) and vectorized electronic charts and, according to PC Maritime, has a variety of innovative chart handling tools that make working with raster charts as easy as working with vector charts. (Source: *Ocean Voice*, April 1996)

Spectec launches turn-key package to comply with ISM code

Norwegian shipping software specialist Spectec has become the first to launch a full, turn-key package aimed at ensuring compliance with the forthcoming ISM code.

Designated Amos-ISM, the new package is an extension of the company's established and successful Amos suite of shipping software programs.

The ISM codes required that critical on-board operations such as maintenance, cargo handling and navigation must be documented. Implicit in this requirement is a need for high-quality, cost-effective computerized management systems.

According to Spectec, Amos-ISM simplifies and shortens the time-consuming process of setting up and running a planned safety and management system. (Source: *Ocean Voice*, April 1996)

Marine Data unveils new fast ferry compass design

Marine Data has developed a transmitting magnetic compass (TMC) for larger high-speed craft. The company says that until now electromagnetic compasses have been ineffective in operating within the demands of high speeds and excessive rates of turn produced by many fast ferries.

Marine Data has refined several existing TMC features to develop a high-speed magnetic compass that could prove valuable in light of forecast IMO and ISO regulations requiring fast passenger ferries to have a statutory magnetic compass back-up to their mainstay gyrocompasses.

The new compass, which can function as a TMC by fitting an electromagnetic sensor coil, has been developed using ring magnetic technology. It contains a specially devised compass card and to withstand the effects of high speed, the viscosity of the damping compass fluid has been revised. The option of replacing the statutory reserve gyrocompass with an efficient TMC will be more cost-effective for operators.

Marine Data has also recently produced a new version of its compass headings comparator for fast ferry applications. Designed for console mounting within the latest generation of integrated bridge, this compares headings from up to three different sources. (Source: *Fast Ferry International*, April 1996)

New aluminium welding method developed

Swedish company Esab Welding Equipment has launched what it describes as an entirely new method for welding aluminium. Called Friction Stir Welding, it is currently being used for the first time on a production basis by Marine Aluminium in Haugesund, Norway.

Describing the process, Esab says the friction from a rotating tool in combination with high pressure plasticizes (softens) the surrounding material. The method has been developed by the British Welding Institute and has been approved by Det norske Veritas. Esab is responsible for manufacturing the production equipment. It will be marketed under the name of ESAB SuperStir.

Marine Aluminium specializes in the production and welding of large aluminium structures for fast ferries, helicopter decks and structures for the offshore industry. (Source: *Fast Ferry International*, April 1996)

Daewoo takes over Romanian shipyard

Daewoo, the acquisitive South Korean industrial group which is already one of the biggest foreign investors in the former Eastern bloc, is to take control of one of the Black Sea's most important shipyards.

Under an agreement signed in Bucharest, it is to invest $53 million in a 51 per cent stake in Romania's 2 Mai shipyard at Mangalia, 45 km south of Constanta, the country's main Black Sea port. After Constanta, 2 Mai is Romania's second largest shipyard with the capacity to build and repair ships of up to 200,000 deadweight tons.

It has two docks including the largest repair dock in the Black Sea and also produces rigs and equipment for the country's offshore oil industry.

Romania, which has 12 shipyards, has one of the world's largest shipbuilding industries; the joint venture, first planned two years ago, was delayed partly due to local opposition to selling a company considered of strategic importance to a foreign investor.

Privatization officials said Daewoo's investment, to be paid in instalments, would boost quality and productivity at the shipyard and that the company had agreed to maintain a workforce of 3,400 for at least two years. Although 2 Mai, built 20 years ago, has orders until 1997, it has been constrained by its outdated technology.

The aim is to increase production from less than one ship a year to more than six and to lift the number of ships repaired at the yard to over 100 a year from about 40 at present. Around 80 per cent of the yard's business comes from outside Romania. (Source: *Financial Times*, 28 May 1996)

Escape systems

Escape systems from offshore installations can themselves be a liability to human health, if evacuees hit the water too fast or at the wrong angle. Several new initiatives are under way to tackle this problem in Europe and Canada. Lifeboats are normally mounted parallel to the sides of an installation and lowered by fall wires from a davit on the muster deck. There is the risk, though, of the lifeboats not clearing the installation and therefore suffering impact damage.

A possible solution is Seascape, developed by Seascape Systems of Newfoundland, Canada. This comprises a deployment arm, a winch and a TEMPSC survival craft. On a semisubmersible, the arm's base is supported at two pivot points on a transverse tubular, either at the stern or bow. The arm extends up to deck level where its peak supports the craft—so positioned as to point away from the installation.

The TEMPSC is also mechanically pivoted, allowing zero-degree trim to be maintained constantly during launching. Both the craft and deployment arm are held in place by a cable extending from a special winch (located on the deck) to the arm's upper point.

Norway's Harding Watercraft has developed a new lightweight free fall lifeboat seating 18 people. Prototype tests proved it could be dropped from heights up to 40 m without hitting the sea too hard.

Originally, the craft was designed for not normally manned installations, but the 18 seats match existing helicopter capacity. Costs are claimed to be substantially lower than existing crafts.

The rise of floating production vessels has also imposed demands on suppliers of alternative escape systems.

Selantic is providing two evacuation systems, each incorporating the Selantic chute, a 25-person boarding platform, four 20-man life-rafts, a stabilizing weight and a hydraulic power pack to allow recovery of the system after deployment.

For this ship-shaped installation, the system has to be compact, light and neatly stored inboard, but also quickly and simply moved into a cantilevered position during deployment. During operation, 15 people per minute should be able to evacuate the vessel safely into one of the four life-rafts.

In Britain, the Health & Safety Executive (HSE) has also supported development of collapsible stairways and escape chutes, following recommendations to investigate the practicality and safety of these systems. Successful trials of two systems have recently been completed.

Telescape, made by a company of the same name in Great Yarmouth, is a telescopic chute which conveys evacuees rapidly to sea level in a collecting pontoon before transferring them to life-rafts or fast rescue craft. Telescape is containerized, with a fixed or compliant boom.

Chutes and collapsible stairs have an advantage over fixed stairs or ladders in that they are positioned away from the platform—hanging from an overhang or cantilever. They also avoid the difficulties that seem to be inherent with use of knitted ropes. (Source: *Offshore*, Mary 1996)

New portable survey depth recorder from Raytheon

Raytheon Marine Company of New Hampshire, USA, has developed a state-of-the-art electronic survey instrument to generate precision depth recordings and digital data output.

Low power consumption, profitability, ease of use, rugged construction and built-in communication interfaces for navigation/data logging devices are claimed to make the DE719D Mk2 ideal for field use.

The instrument is housed within a robust, splash-proof aluminium enclosure and comes complete with a 200 kHz (nominal) transducer and an integral thermal chart recorder mechanism.

Digital processing enables the instrument to offer automatic bottom digitizing capabilities. When interfaced to a NMEA 0183 compatible position sensor, the DE719D Mk2 provides the user with a complete integrated hydrographic survey environment. All operating parameters are at the user's fingertips, with immediate selection feedback provided via LCD display.

The instrument features a built-in digitizer with RS232 and RS422 data output interface ports; user-selectible DC or AC input power; automatic chart annotation for date, time, depth and position data; non-volatile internal clock and important parameter set-up memory; remote event mark input; and sealed keypad and LCD for data entry and read-out. (Source: *The Dock & Harbour Authority*, May 1996)

OSPREY update

Fathoms, the multidisciplined marine services company, has been awarded the contract to salvage the Osprey, the world's first prototype wave-powered generator installed in the summer of 1995 off the Scottish coast.

The contract is to locate and clear the wreckage and debris from the seabed.

Osprey, which developers hoped would provide reliable and sustainable energy from wave power, broke up just three days after its installation. (Source: *The Dock & Harbour Authority*, May 1996)

Tideland equips new Algerian port

Tideland Signal Ltd. has won a contract to supply the entire navigational aids package, including buoys, lanterns, a fog signal and an advanced buoy-mounted racon system, for the newly created Port of Jen Jen on the Algerian coast.

Jen Jen is the commercial and fishery port of the town of Jijel on the Mediterranean coast east of Algiers between Constantine and Annaba.

There are 11 navigation lights at Jen Jen, all chosen from Tideland's MaxLumina range and all fitted with TF-3B Micro-Power multi-code flasher/lamp changers. Three solar-powered ML-140 lanterns will be mounted in Tideland skirt-type steel buoys—one of 3 m diameter and two of 2.5 m—and will mark the approach to the harbour. The company is also supplying the mooring system for the buoys although the concrete sinkers will be made locally to its drawings.

A further eight lanterns, five ML-155 and three ML-300 with clear, blue, red or green lenses will be used to mark navigational channels around the port. The fog signal is Tideland's AB-560 Audiobeam multi-emitter

stacked array which has a range of two miles and is supplied complete with telemetry equipment to allow remote monitoring.

Finally, perhaps the most significant item in the contract is the company's microprocessor-controlled SeaBeacon 2, X and S band racon, which is designed to respond simultaneously and with a unique level of frequency accuracy to the radars of any number of vessels within line-of-sight range, even those with very narrow receiver bandwidths, such as fishing boats.

The system gives radar operators an exceptionally clear indication of a vessel's identity and location, while proportional scaling ensures that the racon trace remains clearly visible on radar displays, regardless of the range scale selected. A remote keypad control allows operators to monitor the racon's performance and, without opening the housing, to fine-tune its operating character to suit local conditions. (Source: *The Dock & Harbour Authority*, May 1996)

Autronica berthing aid for Korean jetties

Autronica Industrial Ltd. has been contracted to supply the construction company Hanjung with three guidance systems to automate ship berthing for its client, Korea Electric Power Corporation (KEPCO).

The systems are due to be installed on KEPCO's jetties at Samchonpo in September 1996, and will help to berth ships bringing coal supplies with greater safety and efficiency.

Compared with other approaches to automating ship berthing—using laser or sonar technologies—the GX-100's radar beam provides accurate information regardless of weather, guiding ships in heavy rain, snow or other adverse conditions. The systems work over a range of up to 200 m, providing real-time data on approach speed, ship-to-jet distance and ship angle. This information may be sent to control rooms, to large displays for outdoor sites on the jetty side, or transmitted to remote portable displays for use on the ship or tugs. (Source: *The Dock & Harbour Authority*, May 1996)

New system increases small ROV systems' performance

PP Electronics Ltd. (Aberdeen, Scotland) has introduced a system designed to increase the performance of small ROV systems. The new control system, Apache, was designed as a result of consultation with owners of Phantom-type vehicles. According to the company the use of this system creates a considerable increase in performance and facilities on many of these vehicles.

The increase in performance greatly extends the operating abilities of these vehicles and allows them to undertake more difficult tasks in harsher conditions. (Source: *Sea Technology*, June 1996)

Seabed system upgraded to incorporate NOAA charts

The RoxAnn™ Seabed Discrimination System can now incorporate National Oceanic & Atmospheric Administration navigational charts. RoxAnn—which is manufactured by Marine Micro Systems Ltd. (Aberdeen) in association with Seatech International—displays real-time information in 3-D. The image can be viewed from different angles and perspectives on screen. Switching between the 3-D image and the normal 2-D display is carried out simply with one-button control on the mouse or trackerball. (Source: *Sea Technology*, June 1996)

Connector completes DeepStar qualification testing

Hydril Co.'s (Houston) series 2000 connector—which replaces traditional pipeline welding—has successfully completed the DeepStar-sponsored test program aimed at qualifying the connector for S-Lay and deep water J-Lay pipeline installation and service.

Three samples of 8- and 12-inch size were subjected to rigorous testing at Stress Engineering's Houston test facility. The test regimen included make/break demonstration, installation-load application, cyclic-internal pressure, thermal cycling, external-pressure integrity, torsional locking and pipe burst. (Source: *Sea Technology*, June 1996)

New downhole probe could save oil industry millions

A small probe that can be inserted into a wellbore to measure downhole temperatures could save the oil industry millions of dollars by allowing more effective treatment for paraffin accumulations in oil wells.

The probe was developed at Sandia National Laboratories (Albuquerque, NM) and is being manufactured by Flexbar Inc., an oil-field equipment manufacturer based in Odessa, TX.

Development of the downhole temperature probe grew out of the study of an oil field practice known as "hot oiling". This is the practice of pumping hot oil—or in some cases hot water—into a well to melt paraffins that solidify when oil cools as it is pumped up the wellbore. These paraffins are a problem because they can gradually choke off production. Hot oiling is the first treatment used to prevent paraffin buildup. Chemical treatments or tubing scrapers also may be used. However, these methods each have drawbacks.

The temperature probe was developed under the Natural Gas & Oil Technology Partnership, a cooperative effort of the US Department of Energy, its national laboratories, and the American petroleum industry. (Source: *Sea Technology*, June 1996)

MIT invention decreases marine-cable vibrations

Researchers at the Massachusetts Institute of Technology (MIT) have built a prototype device to absorb the vibrations of underwater cables. Such shaking causes problems for scientists, fishermen, oil companies, and virtually anyone else who relies on some combination of ropes, cables, pipes and casings in marine environments.

A cable in the ocean vibrates because water flows past it and creates a turbulent wake. As vibrations increase, so does the resisting force—known as drag force—that is exerted on the cable. This can cause a variety of problems. For example, the increased drag force on a shaking cable connecting an anchor, scientific instrument, and buoy may pull the buoy under. Increased drag can also make it difficult to tow underwater cameras or vehicles and cause wear and tear on cables—particularly at termination points.

Many attempts have been made to minimize vibrations. The type of device that works best has an airfoil-shaped fairing made of plastic that fits over a cable. However, such casings are very expensive and will not pass through pulleys or winches.

The MIT team designed and built a prototype vibration absorber. The apparatus concentrates on the

terminations of cables. Vibration amplitude builds when waves travel down the cable, hit the ends, and are reflected back into the centre of the cable, creating standing waves. Rather than eliminating the source of vibration—the turbulent wake—this invention diminishes the steady-state standing wave vibration by absorbing waves incident on the terminations.

The apparatus was first tested in the laboratory and then moved into Massachusetts Bay. There, experiments were conducted in 100 feet of water with one cable termination attached to a small boat and the other attached to a V-fin towing device. The investigators measured vibration and found roughly a 50 per cent reduction in vibration amplitude. (Source: *Sea Technology*, June 1996)

New type of contra-rotating propeller system

The five companies of Kawasaki Heavy Industries, Ltd., Sumitomo Heavy Industries, Ltd., NKK Corp., Hitachi Zosen Engineering & Construction Co., Ltd. and Mitsui Engineering & Shipbuilding Co., Ltd. have jointly developed a new type of contra-rotating propeller (CRP) system that enables fuel conservation of marine vessels.

The ordinary type of propeller generates an energy loss during the ship's propulsion due to water flow rotation, but with CRP, the two coaxial propellers are contra-rotated to prevent losses caused by the water flow rotation. The system can be applied to any type of vessel and enables fuel conservation of over 10 per cent, and with very large crude carriers (VLCCs), fuel savings of 13~15 per cent is possible. These companies plan to introduce the new CRP system in the new ships to be built from now on.

An integrated program was developed to design the optimum propellers for energy conservation on all kinds of vessels, which was realized through the application of advanced fluid analysis technologies and the development of an optimum CRP design program, a characteristics computing program, an oscillation estimation program and a real ship main engine output estimation program.

More information is available from Kawasaki Heavy Industries, Ltd., Public Relations Dept., 2-4-1, Hamamatsu-cho, Minato-ku, Tokyo 105 (Fax: +81-3-3432-4759). (Source: *JETRO*, June 1996)

Racal-Decca bridges ordered for SuperSeaCats

Racal-Decca Marine has been awarded a contract to supply MIRANS integrated bridge systems for the first two 100 m SuperSeaCat monohulls ordered by Sea Containers from Fincantieri. Due to be delivered in September, the systems will have interswitched X and S-band Bridge-Master 340 ARPA radars connected to high-speed antenna turning units.

The installations will also include a ChartMaster CM200R electronic chart module within the bridge array and another ChartMaster as an independent auxiliary workstation. Both will be capable of displaying ARCS raster charts from the UK Hydrographic Office and vectorized charts. (Source: *Fast Ferry International*, June 1996)

General Oceanics & Woods Hole marketing new underwater frame

General Oceanics Inc. (Miami, FL) recently signed an exclusive licensing agreement with Woods Hole Oceanographic Institution to manufacture and market its new underwater frame for supporting instrumentation and water sampling bottles. The new frame is free to slide vertically down a wire rope with no electrical connection to the ship. This method of lowering the system through the water column decouples the entire system for the ship's roll.

Data collected from instruments are stored in the company's Mermaid system, an intelligent data logger and system controller. Through the use of an acoustic modem, the Mermaid will control the closing of water sample bottles while acquiring CTD data. Sub-sampled data are provided to the ship by the same acoustic modem.

As a result, CTD data quality is improved as is the cability to work in more severe sea states. Cable damage is reduced and the need for expensive slip rings, conducting cable, and motion-compensated winch systems is eliminated. Deployment time of CTD Rossette® systems is significantly reduced. (Source: *Sea Technology*, June 1996)

Submetrix ISIS 1000 system proves successful in Belfast

Submetrix Ltd. (Bath, UK) recently completed a survey in Belfast Harbour using its newly introduced shallow-water ISIS 1000 system. Like the well-established deep-water version, this system is a true interferometry sonar. It generates swath widths up to 15 times water depth, together with vastly increased data density—typically up to 2,000 points per ping and 36 million soundings per hour.

In Belfast, the existing dredged channel between the harbour and the open water is approximately 9 km long and 150 m wide. Plans are to double this width and therefore a pre-dredge survey 500 m wide was required down the whole length of the channel. Beyond the channel, much of the area has water depths of a meter or less above the datum.

In depths as little as 1 or 2 m below the keel, the system produced swaths of 10 to 15 m widths. In depths of just 10 m, the swaths opened up to 120 m, amply demonstrating the benefits of interferometry and reducing the time on task to a minimum.

The ISIS system also produces simultaneous side-scan data that can be output to a thermal recorder while also being available in real time on a VDU. The system is compact, quick and easy to operate on vessels of opportunity and compatible with existing motion reference units. Data can be dealt with efficiently using Submetrix's own QA or post-processing software or—alternatively—it can be input to a variety of third-party charting packages. (Source: *Sea Technology*, June 1996)

Smoke hood

Vaasa-based Kemira Safety has developed a smoke hood suitable for heavy duty situations offshore. Wearers include platform personnel with British Gas, Phillips and Total in the UK, as well as numerous international drilling contractors.

The Civic smoke hood is basically a filtering device attached to a hood, made from a combination of PVC and other materials. Key features include:

- Flame retardant tested at 850° C.
- High-performance CO-filter also protects against hazardous gases such as hydrogen sulphide and hydrogen cyanide.

- Quick and easy to pull over the head with self-adjusting straps. The hood can be worn over spectacles, facial hair and beards with no loss of protection.
- Large visor provides wearer with a full field of vision.

Connected to the hood is a comfortable half-mask, sealed via an elastomeric neck seal. Hoods come packed in an airtight bag to preserve the life of the filter. This bag includes an inspection window with a colour indicator showing the condition of the filter. (Source: *Offshore*, July 1996)

Lashing sets exceed breaking load and tensile tests

New lashing equipment which has been developed by Cargo Safe SOE for the shipping sector could also be of interest to offshore users. The product is SOE's New Ro-Ro Weblash 96, known in short as Superlash.

The company recently delivered its first order, comprising 750 Superlash sets and 1,000 m of spare webbing for the Gotland Shipping Line. Superlash displays a strength which is more than sufficient to cope with the 12-ton breaking load without permanent deformation recommended by the IMO.

Det Norske Veritas has recently introduced a new lashings regulation incorporating much more tougher standards than hitherto. Whereas previously there was only a breaking load requirement to be met, safety factors of 3:1 for the webbing and 2:1 for the tensioner have now been set.

Superlash is able to meet all the new requirements. Its pre-tension ability is an unprecedented 1,200 kg, double that of SOE's well-established A2 Weblash SQ lashing. This has been achieved by doubling the single length of webbing.

The high strength and good safety qualities displayed by Superlash make it suitable for offshore applications, where the safety factor requirement is often double that set for the shipping sector.

Release mechanism

Superlash also incorporates a quick-release mechanism for emergency use, another feature that is important in an offshore context. All that is needed is a quick kick of a lever which forms part of the winch and the tension in the lashing is released. The device has been patented.

Another point of interest is that the Superlash webbing is not stitched to the winch, as is traditionally the case with lashings. Instead the winch and webbing can be assembled on board ship, and the webbing can be replaced on the spot when it becomes worn or defective.

This is a simple development, but one which makes life much easier for the user by saving both time and the cost of carrying extra stocks of lashings to cover for those requiring repair. Lashings in which the webbing is stitched to the winch have to be sent back to the maker when the webbing needs changing. (Source: *Offshore*, July 1996)

Hagglunds motors aid cable control on frontier seismic surveys

Two ranges of motors from Hagglunds Drives are powering the winches on two of the world's newest and most advanced seismic exploration vessels. Earlier this year, PGS Exploration took delivery of the Ramform Challenger, its second vessel of the "Ramform" design with the wedge-shaped hull.

As well as having a deeper draught (7.3 m) and being 4 m larger, at just over 86 m, Challenger has increased thrust power and 16 winches capable of towing 16 streamers. The Explorer has 12 streamer winches.

For the Explorer's winches, Hagglunds supplied hydraulic drives from its established Viking 84 series. This vessel, designed by Odim of Ulsteinvik, Norway, made its maiden working voyage in May 1995 over Shell UK Expro's Brent Field. Two of the motors, with reduced brake capacity, power 20-ton wide tow winches. Two more power two 40-ton winches, with 10 Hagglunds Compact motors used for the 10-streamer lean-in winches.

A 470 km^2 area was mapped over a period of two months: for this job, the Ramform Explorer towed eight seismic cables, each 3.6 km long. The distance between the cables was 75 m, giving a total scanning width of 525 m.

At full capacity, the vessel's winches were designed to control twelve 6-km-long cables. To ensure the levels of control and positioning accuracy needed for such a task, which had not been attempted before, ODIM selected Viking motors to power the winch drums. Viking is a high-torque, low-speed motor which can be mounted directly on a winch drum or to a shaft without intermediate gears.

Mechanical and starting efficiency is 97 per cent. Because of the extremely low moment of inertia, the motor is virtually insensitive to shock loads. Viking can also drive and brake in both directions with variable speed.

Ramform Explorer's 40-m-wide stern allows it to tow the 12 cables at a depth of 7-8 m. At the end of each cable is a navigational instrument that determines the cable's exact position.

The onboard winches can control positioning with high precision, due to the ability of the Viking motors to start, stop or reverse with no limitations and at maximum torque. Towing power control is claimed to be so exact that operational interruptions are kept to a minimum: this also minimizes risk of damage to the (extremely costly) cables.

For more information, contact Ingemar Borg, Hagglunds Drive (Tel.: +46 660 87000; Fax: +46 660 87170). (Source: *Offshore*, July 1996)

Monohull ascendancy

Thirty years ago, exploration drilling units broke free of seabed support and became mobile. In recent years, it has been production's turn. Are such conventional structures as steel spaceframe jacket platforms and concrete gravity structures doomed?

The industry is marching steadily towards the compliancy end of the motion response spectrum and away from restraint. With two exceptions, most fields can be produced more economically with moveable structures, meaning monohull and semisubmersible floaters, jackup production units, tension-leg platforms, spars, etc.

In shallow water, there are no competitors to conventional steel spaceframe and monoleg jackets. And where ice floes are involved, fixed concrete gravity structures are more economic because production stoppage remains a large liability with mobile systems. At one time, this was the case for the North Sea, but no longer.

Monohull floaters are squeezing out semi-submersible units as the production technology of choice in the North Sea, because the hulls are widely available or easy to build, and the mooring, swivel and product-transfer technology hurdles have been overcome. Phillips Petroleum recently predicted that 33 per cent of new development investment in the North Sea will go to subsea equipment, 29 per cent

to production vessels and equipment, 24 per cent to mobile platforms, and only 10 per cent to conventional platforms.

Two recent fabrication orders provide examples of how both production and drilling technologists view the future:

- Mobil and Oceaneering are converting a very large crude carrier with a length of over 1,100 ft and capacity to store 1.8 million barrels (bbl) to produce from the Zafiro Field off West Africa. Given the limited knowledge about the field at this time, the tanker will act an early production system, but it has the reserve to operate long term if needed. The $70 million conversion cost for a vessel that can be used on other fields afterwards leaves room for error on field estimation.
- Sonat Offshore is contracting for a drillship that will be 850 ft long and twice as wide as existing drill ships. Not only will the vessel's size make it extremely weather-resistant and capable of drilling in the deepest water, but it will also allow multiple functions on deck, significantly cutting back on drilling, completion, and field hookup time.

Both monohull units will provide a huge amount of reserve and flexibility, in terms of on-site operations as field development timing. (Source: *Offshore*, July 1986)

Green water-loading, structural fatigue subject of study

The trend to increased use of tankers for floating production and storage operations in the North Sea has forced operators there to take a closer look at two problems specific to tankers: green water-loading (waves on the deck) and structural fatigue.

Green water-loading upon a hull constrained by a turret or bow mooring and loading system presents a different set of forces than free motion response. As an alternative to simply reinforcing the hull, The Marine Research Institute in the Netherlands (Wageningen) is studying varying bow shapes to prevent shipping the water in the first place. However, alternative shapes have impacts on drift, mooring and deck processes, and this will also be studied.

The Institute, along with Bluewater Marine, is also compiling a database to monitor fatigue loads and structural responses on floating monohull production systems and develop analytical tools to assess fatigue in new systems. (Source: *Offshore*, July 1996)

Petrobras uses taut mooring synthetics

Petrobras will be the first operator to permanently moor production units with synthetic fibre ropes. The semisubmersible floating production platforms P-19 (*Stawinner*) and P-26 (*Illiad*), will be moored in 2,500 ft and 3,250 ft water depths, respectively.

Each floating unit will use 16 polyester tethers in a taut-moored arrangement. Each 21 in. diameter tether will have a 700-ton breaking strength. Marlow Ropes (Hailsham, UK) will supply the tethers. (Source: *Offshore*, July 1996)

High-capacity air-powered diaphragm pumps

Edson International, New Bedford, MA, is highlighting its high-capacity, air-powered diaphragm pumps as a more relaiable way to handle black and grey water on large yachts and work boats. The Edson Bone Dry 120 series has a maximum volume of 40 gpm, suction and discharge heads of 15 ft, and uses only 15 cubic feet per minute of air at 85 psi. The pump weighs 35 lbs and has a footprint of 10.5 by 17 in. (25.5 by 43.2 cm). The pump can run dry indefinitely and do double duty as a bilge pump. For further information contact Edson International (Fax: 1-800-338-5021; e-mail: Pumps@EdsonIntl.com) (Source: *Offshore*, July 1996)

Contracts

Pinpoint Systems International, Washington, D.C., has installed an alarm system on fourteen vessels of Zapata Protein, Inc., Cameron, LA. The installation provides the Zapata fleet with audible proximity alarms, which give vessels 100 m advance warning of restricted areas. The system will help the vessels operate more efficiently by giving captains the option of saving unlimited past tracks and building a customized database of fishing locations.

Sonsub International Ltd., Aberdeen, Scotland, has formed a worldwide cooperative agreement with The Seateam Group to provide integrated ROV and survey services, including Seateam's proprietary Dolphin™ data-capture and management system. The companies have mobilized on board the STM *Markab* to support a major project in the North Sea. Sonsub will deploy an ROV through the vessel's new moon-pool, which is an innovative new design aimed at dramatically increasing the vessel's all-weather capabilities.

Datasonics, Inc., Cataumet, MA, has announced new contracts from the US Geological Survey (USGS), GAS-Italy, and the Korean Oceanographic Research and Development Institute. The USGS contract is for a seafloor survey system to collect high-resolution chirp sidescan and chirp subbottom profiling data. It will be used to generate a database of the shallow-water shelf, rivers, lakes and estuaries. For the GAS-Italy contract, Datasonics has integrated the Model G-880 cesium magnetometer into the SIS-1000 seafloor imaging system for pipeline and cable surveys in water depths of up to 1,000 m. The Korean contract is for an SIS-3000 deep tow system for full ocean depth mapping.

Stolt Comex Seaway S.A., Aberdeen, Scotland, has signed an agreement with the State Oil Company (SOCAR) of Azerbaijan to form a joint venture company to provide subsea services to oil companies operating in the Azeri and Caspian offshore areas.

The company will be based in Baku, Azerbaijan. SOCAR is a major oil and gas producer in the Caspian Sea. In 1994 it signed a production sharing agreement (PSA) with a consortium of eleven oil companies led by BP and Amoco, for the exploration and development of the Azeri, Chiurag, and Guneshli fields in the Caspian Sea. The contract area covered by the PSA has estimated recoverable reserves of more than 4 billion barrels of oil. Production is planned to start in the latter part of 1997. For further information contact Stolt Comex Seaway S.A. (Tel.: +44 (0) 1224 718200. (Source: *MTS Currents*, July/August 1996)

ABS launches products to advance ship safety

At a special presentation held at the Posidonia International Maritime Exposition in Greece, the American Bureau of Shipping (ABS) announced the introduction of two new products: SafeHull '96 and SafeNet™.

SafeHull '96 is an extension of ABS's revolutionary SafeHull™ system—a dynamic-based method for design and evaluation of ship structures. The SafeHull™ '96

initiative extends this technology from tankers and bulk carriers to container ships. It also introduces more flexible and user-friendly features including Windows PC and workstation operating environments. Dedicated training and support teams have been added, as well, to better serve users.

The capability to perform dynamic analyses through SafeHull™ has armed ABS with a unique and powerful tool. This provides the capability to analyze ship structures from a real life, first principles basis, in a way not previously available to the marine industry. Having developed its use to identify critical structural areas during the design and evaluation phase and to realistically account for the dynamic loading pattern a ship experiences throughout its lifetime at sea, ABS is now taking the application of SafeHull™ into another dimension by incorporating it into an entirely new ship-management product called SafeNet™.

SafeNet™ is a life cycle ship management and information network designed to assist shipowners with the increasingly complex task of managing their vessels. The network will give owners the capability to directly access all classification-related technical and survey information for both the machinery and hull structure on their ABS vessels. ABS and the owner will be able to work together to continually assess the integrity of both hull and machinery in order to develop a planned maintenance programme for executing surveys, maintenance and repair. (Source: *Ports and Harbors*, July-August 1996)

European consortium to develop IPSI

Norway's Kvaerner Ships Equipment is leading a Pan-European consortium which has been given the task of developing an improved port/ship interface (IPSI) for Europe to take the shipping industry well into the next century.

The project will result in lower cost port facilities and cargo handling equipment, as well as new ship types, cargo handling technology and management/information exchange systems.

The contract to carry out the IPSI project, awarded by the European Union in Brussels, is being undertaken to improve door-to-door logistic chains in Europe by increasing the use of waterborne transport, both short sea and inland waterways.

The goals of the IPSI project are as follows:

- Develop new concepts for flexible port/ship interface in the context of added value, intermodal logistics (where applicable) in Europe, based on increased use of waterborne transport, including the utilization of inland waterways;
- Develop methods and equipment for effective transfer of cargo and information about cargo in the above-mentioned land/water interfaces, with focus on high efficiency and low investment;
- Demonstrate the new "port/ship and ship/ship interface concept" to verify the effectiveness of multimodal cargo exchange in a "door-to-door" context.

The challenges for the IPSI consortia are the following:

- In order to succeed in transferring much of the transportation of goods in Europe from land to sea, the complete logistic chain, using waterborne transport as a major component, must be competitive, both in terms of cost and reliability.
- Since cargo must be moved between ship/barge and land transport systems twice, the efficiency of the port/ship interface in the multimodal context of a door-to-door logistics chain is of vital importance;
- The challenge to the ports is that they must become more important interfaces in the transport chain as efficient and cost effective logistics hubs where all available modes of transport can be effectively interconnected. This applies to sea, rail, road and to inland waterways as well;
- The interconnection of alternative modes of transport must be based on competition and flexibility, i.e. interchanges between the various modes of transport must be possible wherever necessary and applicable.

The IPSI project, which officially started on 11 April 1996, is scheduled to last 36 months, at the end of which the results and conclusions will be made public. (Source: *Ports and Harbors*, July-August, 1996)

Harland wins order to repair Sea Empress

Harland and Wolff, the Belfast-based shipbuilder has won a multi-million pound contract to repair the oil tanker Sea Empress, which ran aground off Milford Haven earlier this year causing massive pollution.

The yard was one of four across the world that tendered for the contract, which will take until late spring next year to complete and will involve replacement of 2,800 tons of steel.

It is the largest repair job ever undertaken by Harland and Wolff. The contract is said to be worth over £10 million.

The Belfast yard was always front runner to win the contract as the Sea Empress was towed to their dry dock in April following the spillage for tank cleaning and an assessment of the damage to determine whether the vessel should be scrapped or repaired.

The vessel poured 72,000 tons of oil into the sea off the Welsh coast when it ran aground and continued to leak small amounts as it was towed across the Irish Sea to Belfast. (Source: *Electronic Telegraph*, Issue 461, 27 August 1996)

C. TECHNOLOGY UPDATE

Foam cores rising

The concept of using low-density foam cores is not new. As long ago as 1960, the benefits of sandwich construction were being touted to a small, but growing sector of innovative designers and engineers in the USA.

The predictions may have had a familiar ring of overoptimism about them. But they did, none the less, become commercial realities.

To illustrate the potential of foam core composites, it is worth looking at the marine industry. Shipyards picked up on the idea of using composite materials and sandwich technology to manage their weight problems.

Core materials, notably PVC and balsa wood are used almost routinely today, mainly for smaller and medium-sized vessels. Large vessels are about to follow suit because of the overwhelming need to shed structural weight, allowing higher speeds and heavier payloads. In addition, lightweight foam structures can also solve problems with the gravity point of the larger ships.

One of the most impressive examples is the new Stena HSS fast-ferry built by Finnyards. Although the ferry has an aluminium structure, large amounts of composites are used in different sections. Low temperature-curing epoxy pre-pregs are partly used as the skin material. This indicates that besides the most common wet lay-up manufacturing method, the aerospace fabricator's pre-preg system is now entering the shipyards. In addition to solving styrene emissions, pre-pregs offer much cleaner manufacturing.

The next logical step in the chain of events will be the introduction of high-modulus foam core materials, offering better strength-to-weight ratios. PMI foams (polymethacrylimide), for example, would appear to be an ideal choice, and have in fact already been used successfully, above the water line. Target areas include outer sections, and interiors where stringent fire and safety requirements have to be met, or where high thermal loads exist.

A limiting factor for boat hulls is the relative brittleness of current PMI foams. This has, however, prompted the development of a new generation of much more ductile PMI foams to fill this gap.

For many marine design engineers, lightweighting has become synonymous with vessel performance. All-composite hovercraft and patrol boats are as real today as composite helicopters and jets, and parallels with the aerospace industry are clearly visible in the new, ultra-light designs which have emerged from the marine industry's drawing boards in recent years.

The advantages vary from higher speed and lower fuel consumption to higher payload, in addition to zero corrosion. PVC foam was not considered as a core material owing to its poor fire behaviour—PVC releases larger amounts of chlorine-based gases when burnt, harmful to passengers and equipment alike.

Composite materials, including foam cores, currently face stringent regulations on fire performance, particularly where transportation of passengers is concerned. The A-60 test for marine vessels, requires a panel to be exposed to 940° C for one hour.

Although composite-based materials can be designed to meet A-60 the solutions are not lightweight.

PMI — key facts

PMI foam has been used for composite applications since the early 1970s. Key selling points of the technology include:

- 100 per cent closed cells;
- Process and material is free of CFCs;
- Resistant to harsh solvents;
- Low smoke density, non-toxic combustion;
- High heat distortion temperature, up to 238° C;
- Foam can be processed for up to 4 hours up to 200° C while loaded with 7 bar pressure in the autoclave with minimal creep. No other core material can be processed under these conditions;
- Highly suited to RTM (resin transfer processes).

(Extracted from *Advanced Materials News*, December 1995)

Multipurpose vessels in the North Sea

North Sea operators are looking to reduce costs of planned well intervention/workover programmes. An operation involving equipment retrieval and changeout typically calls for a deep-sea vessel (DSV) and anchorhandler supporting a mobile drilling rig.

Some contractors, however, are using one multipurpose support vessel to handle the work alone. One such vessel is the dynamically positioned monohull *CSO Seawell*, currently working through a busy schedule ranging from tree replacement to well abandonment. Its onboard equipment includes a purpose-built workover derrick with heave compensation and guideline systems.

In partnership with Canco, which provided the subsea wireline lubricator, the *Seawell* first pulled and replaced a National subsea Christmas tree on Amerada's Ivanhoe IK28 production well (the field has been producing oil and gas since 1989 through a subsea manifold tied back to the semisub FPS AH001).

Installation of the replacement tree (also National) is thought to be the first performed by a DP monhull anywhere. Coflexip Stena Offshore set plugs and killed the well before disconnecting the in-place tree and removing it for refurbishment. After the replacement tree was installed, production logging and reperforating of the well was performed followed by setting of mechanical and cement plugs.

A key factor in choosing the *Seawell* was not having to mobilise a rig with attendant anchorhandler. Another advantage is the vessel's virtual all-weather working capability. (Source: *Offshore*, February 1996)

Vessel-deployed, free span support system speeds Transmed installation

Stabilization of submarine pipeline free spans along uneven sea bottoms is conventionally performed using gravel dumping, post trenching or mattresses. However, as SEIC, based in Fano, Italy, points out, these technologies merely support the pipeline; they cannot lift it.

SEIC has developed a new technique which has been applied to support free spans along the 26-inch diameter Transmed gas lines crossing the Sicily Channel in water

depths down to 510 metres. The technology is based on the pipeline mechanical support system Atlantis with its installation module Pegasus: it was developed to cater for requirements such as short installation time, simple interface with the support vessel and pipeline lifting capacity.

Reduced installation time is achieved by automatic operational procedures, including an auto heading function, which are acoustically controlled from the surface. No umbilical cable, winch, slip ring or power distribution unit are necessary, meaning that a vessel equipped with a conventional crane and a support ROV are sufficient to install the system.

The Pegasus module is powered by dedicated battery packs and the ROV is used to provide video images during marine operations and to drive Pegasus hydraulic functions in emergency conditions. Three types of supports, with different leg length and minimum/maximum clamping distance, were built and installed along Transmed in order to satisfy intervention requirements on the expected as-laid configurations.

Atlantis can be installed and subsequently adjusted or removed in water depths down to 1,000 metres. Two different installation procedures, one at pre-set lifting displacement and the other at pre-set lifting force, can be employed to solve free span problems in terms of pipeline stress level.

According to SEIC, the Atlantis/Pegasus system has numerous other advantages over competing techniques. Gravel is subject to scouring and may not ensure a firm support to the pipeline; and post-lay trenching is often impossible due to bottom morphology and geotechnical characteristics. The adjustment and recovery procedures of the SEIC system brings operational flexibility compared with other passive supporting systems, which cannot be removed once installed. (Source: *Offshore*, February 1996)

Seismic-while-drilling acoustics

Logging-while-drilling operations and acoustic sensing tools provide substantial information about formation structure, boundaries and character immediately surrounding the borehole, but very little beyond 5 metres radial distance. Unfortunately, conventional surface seismic resolution, even 3-D seismic, often cannot compensate for the lack of stratigraphic information adequately, especially on deep or subsalt wells.

Oil and gas companies have long pushed for a tool that better defines the formations at some distance from the borehole, without having to pull the drillstring to undertake well-to-well vertical seismic profiling or check shots to the surface. Two joint projects are currently under way to create technologies around seismic systems:

- Agip and Western Atlas are involved in the development of equipment and procedures using drillstring and bit noise sources with surface monitoring. Much of the project is confidential and no results have been announced.
- IKU (Norway) and Read Well Services are investigating both downhole sourcing and receiving processes, with complementary equipment on the seabed, for both drillpipe and coiled tubing. Also, development is under way on receivers that can handle strong vibrations and high temperatures downhole.

(Source: *Offshore*, February 1996)

Castable, weldable boron carbide can replace metals

A new material—more like metal than ceramic—could begin replacing metals on critical lightweight uses where strength and workability is needed. The material is boralyn—a boron carbide metal matrix composite—manufactured by Alyn Corporation of Costa Mesa, CA. The material is already being used on vessel masts, propellers, anchors, archery arrows, skis, bicycle frames and golf clubs.

Boralyn is stiffer and lighter than aluminium, harder than steel, fracture resistant and more predictable than carbon fibre or ceramic composites. The material is available in castable ingots and in extruded forms, and can be welded with metal-welding equipment. Raw materials for boralyn—chiefly boron and carbon—are widely available. (Source: *Offshore*, February 1996)

Long-distance subsea electrical power transmission sought

Petrobras (Brazil) and Siemens (Germany) are jointly developing a method of transmitting electrical power in deep water over long distances sufficient to power submerged centrifugal pumps. With this equipment, the Brazilian oil company will be able to produce many deep-water fields subsea from facilities located in shallower water.

In theory, the system would work as follows: Equipment aboard a shallow water platform would generate power, then run it through a frequency inverter and a transformer. After transiting distances of as much as 35 km, another transformer would convert the current at the wellhead, and send it to the pump. A system at the seabed transformer would circulate oil within to compensate for the external pressure.

Deployment of the first test system is scheduled for December of this year. The Carabepa-3 platform will generate the power. (Source: *Offshore*, February 1996)

Diversity in underwater inspection

Underwater non-destructive testing (NDT) of deep-water structures provides a diverse, hostile and challenging means to implement NDT.

Underwater visual (VT), magnetic particle (MP) and ultrasonic testing (UT) have been in place since the early 1980s, with equipment modified for submergence and closely resembling topside NDT tools. In fact, there are advantages to working under water—such as "no shortage of couplant" and not having to worry about performing MT when it is raining (i.e. wet surfaces).

However, deep-water structures (installed to a maximum of 915 m, or 3,000 ft) represent the most unique of NDT considerations. In the Gulf of Mexico, there are approximately 15 fixed structures installed at a depth of 243-400 m (800-1,300 ft). Deep-water structures have excellent records of structural integrity with an extremely low incidence of corrosion or fatigue cracking problems. The primary reason for developing deep-water NDT capabilities is contingency for damage during installation impact damage from dropped objects.

There are three means used for underwater NDT: diving, atmospheric diving suits (ADSs), and remotely operated vehicles (ROVs).

Diving

Diving is a proven technology. Underwater NDT tools—primarily VT, MT and UT, along with the ability to

perform such supplemental tasks such as grinding out of cracks—are well developed. For example, underwater MT is performed with the same equipment typically used for fabrication (AC articulating yoke), with wet particles delivered via a slurry in a small hand applicator.

At present, saturation dives to 460 m (1,500 ft) have been made. Manned saturation diving presents unique considerations paralleled in few other NDT environments. Saturation diving is a mode in which the body's tissues become saturated with a gas, such that decompressing is required to allow the gas to dissolve slowly, so as not to cause decompression sickness. Once saturation depth is reached, the diver can spend an unlimited amount of time under water without increasing the amount of decompression. The diver descends to the work site via a dry, pressurized diving bell. Upon arrival at site, the diver exits the bell via an opened trunk and at shift completion, the bell is brought to the surface and mated to a pressurized dry topside living quarters complex.

While saturation diving is relatively safe, in the event of a medical emergency all procedures must be performed in a hyperbaric environment. The North Sea maintains an offshore state-of-the-art medical hyperbaric complex in which an injured diver can be transported in a pressurized bell via helicopter which is mated to the land facility.

ROVs

Research and development of ROV NDT technology to replace inspection divers has been happening since the early 1980s. While there may be a tendency to believe that "high tech" advancement lies in automated/computer interfaced systems, such as new generation UT, the basic detection method for underwater inspections is VT. Interestingly, remote VT for detection of "discrete damage" is an emerging technology. Its reliability still requires significant enhancement, especially in the development of reliable supplement NDT methods to proof test suspect visual indications with methods such as MT, UT and grinding. The best abilities of the ROV are for general visual inspection looking for gross damage.

Compared to diving and other teleremote operations (for example using robotics, in a nuclear environment, underwater or dry), offshore ROV operations add another level of complexity, being launched from a dynamic vessel often into sea with several variables. Modelling of ROV motion is so difficult that ROV simulators have yet to be fully developed. In rough sea states, vessel heave, roll, pitch and yaw are translated to the ROV. In addition to these chaotic forces, underwater currents, reduced visibility, geometrical complexity of the structure and obstructions must all be accounted for by the remote pilot via real time multi-tasking.

The advent of advanced sonar display, computer station keeping and fitting ROVs with sophisticated manipulators has significantly enhanced ROV capabilities in many tasks such as construction and other general surveillance tasks. However, full spectrum NDT still remains primarily as a research area.

The largest obstacle remaining for using ROVs to replace divers is the ability to perform grinding and redoing MT as a means to have an "absolute confidence level" in the inspection or to affect a repair by the grinding process. Grinding as a remote task is an extremely difficult problem due to tracking complex weld shapes, required dexterity and access, and the ability to control tool to part compliance. While there are researchers who feel the "virtual reality" tools are potential solutions, one poses the fundamental question: are we performing an amputation or a limb reattachment?

There is an argument that machine inspections can hold tighter positional tolerances than humans, for example in ultrasonic scanners. However, this is somewhat flawed, for two reasons: "real inspection tools" VT and MT do not require this complexity, and offshore structure weld shapes are not conducive to in-service ultrasonic weld inspection.

ADSs

An atmospheric diving suit is a hard shell enclosure with movable arms that allows the operator to perform underwater work without the need for decompression. The maximum working depth of present ADSs is 670 m (2,200 ft). ADS capability compared to divers is quite similar.

The primary constraints are size, which may limit access, and the consideration of hand dexterity that must be given to the design of NDT tools.

The major advantages of the ADS compared to ROVs are the visual presence of the operator and the force-feedback when using tools. There is a major reduction of cost when compared to saturation diving. ADS and ROV costs are comparable.

During a recent industry project including both tank trials and field implementation, an ADS was able to detect visual cracks with high reliability and low false alarms, perform MT, and grind out cracks. In the tank trials, the visual ability of the ROV to detect cracks was unreliable. It must be appreciated that human vision compared to machine is not nearly as constrained in acuity and its abilities to rapidly change target angle, to accommodate depth of field, vibration and movement, and to assess depth perception.

Conclusions

ROVs provide a cost-effective solution when a general visual survey is required. For the majority of deep-water inspections requiring specialized NDT, ADS provide major cost savings compared to saturation diving. The sole limitation for using ADS may be that the damage is located in a difficult to access location.

Indeed, machines may eventually replace manned intervention, especially where the structural integrity of components have been specifically designed for robotic inspection. However, for the foreseeable future, man—wet or dry—plays an invaluable role for the full underwater inspection capability.

For more information, contact: Sea Test Services, 1095 Shady Lane, Merritt Island, FL 32952, USA. Fax: (407) 453-8777 (Extracted from *Materials Evaluation*, March 1996)

Diverless flowline pull-in to well developed

The attachment of flowlines subsea has required divers on the seabed or surface support vessels with winches and remotely operated vehicles to pull together and mate the connections. Both methods were costly, and as water depths increased beyond diver depths, the outlays began to occupy a large segment of the installation allocation. Also, the ideal surface support vessels were not always available.

One of the systems developed to alleviate the surface support vessel requirements is Sonsub's diverless flowline connection system (DFCS), which uses a remotely operated vehicle (ROV) to winch the two components together and make the connection. First use of the system was scheduled to take place in March 1996 in the South China Sea in tests conducted by Amoco and Coflexip.

The system can be used for flowlines, smaller pipelines and virtually all umbilicals. The immediate benefits of the system include the following:

- No cables, other than that for ROV support, are required from the surface;
- The system eliminates pipelay, drilling or winch support vessels;
- The process is effective for single or bundled lines up to 18 inch outer diameter;
- The DFCS work skid can be attached and detached easily to virtually any work class ROV.

Components

The DFCS system consists of an aluminium skid frame, winches, stab-in anchors, tensiometers, guillotines, slide tubes, a docking probe, a multi-port hot stab, clamping arms and the telemetry system. Additional optional components include an air bag inflation system, a clumb weight winch, a direct-deployment frame, a torque tool with vertification, an equipment basket, an external seal test system, a slide tool, a flowline protection cap, and a flowline/umbilical interface.

Providing the connection between the ROV and the DFCS skid is a docking probe. Also, the hydraulic multi-port hot stab connects the ROV hydraulics to the DFCS hydraulic system. If the ROV hydraulic system malfunctions, failsafe disconnection occurs. There are no electrical systems in the DFCS system.

The two winches, which can hold 75 metres of 12.5 ton breaking strength Kevlar rope, can be controlled separately. The retrievable stab-in anchors attach the winch ropes to the subsea structure. Each winch line has a tensiometer to provide tension feedback to the operators at the surface. Guillotines mounted near the tensiometers can sever the winch ropes in the event of an emergency. (Extracted from *Offshore*, March 1996)

PVC foam proposed for loading buoys

Composite materials offer interesting properties for a range of offshore applications, but these are not always recognized by engineering contractors.

Among the advantages of such foam materials are a high strength-to-weight ratio, low water absorption, excellent insulation properties and an ability to withstand rough handling.

Divinycell PVC foam could prove beneficial in offshore loading systems, according to the company which was awarded a contract with Seanor Engineering to supply Divinycell materials for the bodies of the submerged loading buoys for Conoco's Heidrun Field.

However, late design changes were then introduced, and as other parties in Heidrun were unfamiliar with engineering composite materials (allied to the intense time pressures), a switch was made to steel.

Divinycell has also proposed to Coflexip-Stena Offshore that it use composite materials in the underwater buoys forming part of its offshore loading system. PVC foam has several advantages over syntactic material, its main competitor in this application.

In water depths down to 100 metres, Divinycell material with a density as low as 100 kg/m^3 can be used: this is about one-third the density which can be achieved using a syntactic material. It means that a buoy made of Divinycell would be much smaller than one with the same lifting capacity made of syntactics or steel, and would be much less subject to drag in currents.

For subsea pipelines, Divinycell SPI, a cross-lined CPVC foam, exhibits low thermal conductivity and is resistant to deformation over time when under constant pressure (the creep factor).

Divinycell SPI is rated from -200 to +105° C. In the case of very-high-temperature pipeline fluids it would be shielded by an inorganic polymeric material acting as a temperature reducer.

For more information contact Jack Thalin, Divinycell International. Tel.: +46 430 16342; Fax: +46 430 16396. (Extracted from *Offshore*, March 1996)

Landmark trials for electronic charts

The first ships in the world to operate legally with electronic charts as their principal navigation system will go into operation soon. In a trial programme, authorized by the Directorate General of Shipping and Maritime Business of the Netherlands, Broere Shipping and Theodora Tankers, both subsidiaries of Pakhoed, are to conduct an experiment whereby their three newest ships will operate between the North Sea and the Western Mediterranean using only ARCS charts from the UK Hydrographic Office and displayed on Racal-Decca ChartMaster electronic charting systems.

The authorization has been granted on the understanding that each ship is fitted with two independent ChartMaster systems. The vessels are also required to carry a selection of appropriate paper charts of the principal operating areas as a back-up.

The availability of electronic charts from an official source, and reliable hardware upon which it may be displayed, had been recognized by the DGSM as complying with the IMO Maritime Safety Committee circular 566 which advises flag State Governments that they should require a graphical position display aboard their vessels. The ChartMaster systems being supplied to the ships are capable of displaying both ARCS raster charts and also vectorized charts. Although an extensive portfolio of vectorized charts now exists, very few are available from official sources, so the DGSM authorization is based solely on the use of ARCS charts.

The UK Hydrographic Office believes that the experiment is a vital part of proving that raster charts (effectively facsimiles of paper charts) have an equivalency with paper charts. Although IMO set the standard, S57, for ECDIS (vectorized) charts last November, the feeling in the hydrographic community appears to be that raster charts running on suitable equipment are more than sufficient to provide a safe and adequate alternative to the traditional paper chart. (Source: *Fast Ferry International*, March 1996)

Unmanned control buoy in charge of East Spar gas production

Sea Commander, a remote unmanned well control buoy design first patented in 1980, was recently employed in its most sophisticated application to date. The project was for Australia's East Spar alliance, which commissioned the buoy to control four subsea gas wells, 62 km off the Northwest Shelf.

According to consultant engineers Resource Technology Developments (RTD) of Chepstow, UK, the system is capable of controlling and monitoring any number of wells and other types of facilities.

Sea Commander is based on a design of buoy which has been in operation in the North Sea since 1981. The current version was designed to replace the conventional control link between an offshore production platform and outlying subsea production or injection facilities.

It employs a highly secure radio telemetry link to transmit control and monitoring signals between a computerized master control station located on the platform and a remote terminal unit located on a self-floating and stable field control station adjacent to the seabed facilities. A direct hydraulic or electric hydraulic control system effects local control of the seabed equipment.

An hydraulic power generation unit is housed in the field control station to provide for actuation of the seabed functions. Also housed is an independent power source and telemetry and radio equipment necessary to maintain the control and monitoring link between the master control station and the seabed equipment.

All support systems are also contained in the field control station. These include batteries, fuel system and navigation beacons. The unit can also be used to locate pumps and assorted equipment for remote chemical injection, along with chemicals such as MEG, TEG and corrosion inhibitor. The existing design can store up to 700 tons of fluid for use in chemical injection, or as additional fuel for onboard power operations.

The atmosphere of the enclosed area in which offshore equipment is placed and where maintenance is undertaken is closely controlled. Movement is minimal, according to RTD, even during 100-year storm conditions. Heave is less than 1.5 metres and surge is around 12 metres with significant pitch. Maximum acceleration even under the worst conditions is approximately 0.3 g.

Sea Commander can be used at any distance from its control centre using duplicated high integrity communications systems. RTD claims several advantages over conventional subsea control systems, economy being one. The system reduces and simplifies equipment on the seabed and brings it to an accessible environment where it can be inspected and maintained without the use of costly deap-sea vessels.

The buoy comprises a series of tubular sections of varying diameter. These form a column of spar, narrow at the surface with a wide buoyant section some 12 metres below mean sea level. The main buoyancy tank also provides attachments for the tethers which anchor the buoy to the seabed.

Sea Commander can be modified for use in shallow or deep water. In very shallow conditions a buoyant structure is employed based on the conventional catenary-moored buoy, similar to large automatic navigational buoys used by lighting authorities.

Design is similar to the taut-moored buoy, but mooring is achieved by using multiple mooring legs. These are chain catenaries with sinkers attached to high folding power anchors. Mooring design is specific to the selected location. (Source: *Offshore*, March 1996)

Double hulls

Concern about double-hull tanker construction has prompted the US National Research Council to accord top priority to proposed financial year 1997 projects that focus on such structures.

The Council's marine board convened a committee on marine structures to whittle down to 10 a list of 20 structural research projects to be undertaken during the year.

Also important, in the panel's view, was that a number of new double-hull tankers would be built during the next 15 years to replace tonnage that must be retired due to the US Oil Pollution Act of 1990 and International Maritime Organization requirements.

Top priority was accorded to a proposed evaluation of this design on the structural resistance of double-hull tankers to outer hull and cargo tank rupture under low energy impacts.

Key aspects would include integrated inner and outer hull thickness, and their separation and stiffening system design, plus development of integrated bottom-hull design alternatives that minimize the risk of such rupture.

The absence of distortion measurements and control techniques during the fabrication processes led to additional distortion and residual stress formation, which would not develop if control mechanisms were in place.

These distortions produced significant cost increases because of the additional effort required to fit parts together, overweld large gaps, and flame-straighten the final structure. The application of control techniques provided an effective means of distortion reduction, the panel said.

The third project would explore and evaluate alternative stiffening systems of the double-sided and double-bottomed structures of tankers to improve the productivity and maintainability of the structure, and enhance its reliability and structural resistance to accidental loads.

New analytical methods were being developed for double-hull and other configurations, with emphasis on energy absorption capability and reduced outflow from breached tanks.

Current double-hull design and construction were primarily based on conventional ship framing and practices used for single-skin tankers.

Outer skin, side shell and bottom-plating were regarded as prime hull girder components conventionally stiffened with longtitudinals, supported by transverse webs and floors.

The longtitudinals were usually supported by flat bar stiffeners on the transverse web/floor through fillet welds to the longtitudinal flange/face plates.

The other proposed 1997 projects were risk assessment of the use of polymer matrix composites in marine environment, fatigue-resistant detail design guide for ship structures, short course on fatigue and fracture analysis of ship structure, use of adhesives for structural bonding of marine structures, fillet welding of double-bottom structure to resist tank rupture in groundings, sea operational profile for structural reliability assessments, and methodology for systematic collection of corrosion data using ultrasonic thickness measurements of ship structures. (Extracted from *Lloyd's List*, 16 March 1996)

A few drilling difficulties in 10,000 foot depths

What is the difference between drilling a well in 7,000 ft water depths, which has already been done, and drilling one in 10,000 ft depths, which is being considered by at least two operators and a number of drilling contractors?

Early discussions on two such projects indicate that most equipment used on a 7,000 ft well can be extended to 10,000 ft depths, with only a commensurate increase in loading expected. The broadest hurdle appears to be economic, due simply to increased rig time on the hole, especially if the target formations are far below the seabed. Some of the interesting challenges and requirements centre around the following:

- **Surface equipment:** In order to reduce long tripping periods and prevent swabbing, a top drive unit will be necessary. Higher capacity mud pumps will be needed to create sufficient fluid velocity in the riser to lift

cuttings. High tension levels in the drillstring will necessitate the use of the best quality drillpipe.

- **Drilling time:** Drilling and under-reaming on the same trip, optional on strings in shallower water, is a must in very deep water. Separate trips for each function are not economic.
- **Drilling fluids:** Because of exposure to low seawater temperatures through two miles of riser, drilling fluids and cement slurries become viscous. Thin polymer fluids are necessary, accompanied by substantial solids and sand removal and standby dilution. Salt saturation is recommended. A riser liner may be necessary to increase fluid flow velocity.
- **Riser safety:** Risers used in 5,000-7,000 ft depths; can be extended for 10,000 ft depths; however the surface equipment must be able to handle additional riser loads in the event of can flooding or drive-off. There is also a concern that opposed shallow and deep currents could severely contort the riser. Careful control of riser top tension and buoyancy will be needed.
- **Wellhead integrity:** Bending stresses on the ball joint, wellhead and conductor could surpass 200 ton-meters, meaning that wellhead and conductor top joints would have to be stiffened with extra casing and cement to cope with the potential for high lateral and tension forces.
- **Geotechnical:** As in shallower water, the likely scenario is for a highly unconsolidated seabed and aquifer flow zones to at least 1,000 ft below the seabed. A surface casing string within the conductor may be necessary to route water and sand flow to the seabed rather than allowing it to push up behind the conductor. In addition, shallow sediments will not support cement slurries. Once casing is set, numerous leak-off tests will be necessary. High- pressure housings should be locked high in the conductor.
- **Guidelineless operations:** In very deep water, there is a high probability that guidelines used to lower wellhead components or ROV umbilicals will tangle around the riser. Drillers will have to minimize use of both, and provide sufficient standoff for ROV surface support.
- **Flow testing:** Associated gas and water coming from deep high-temperature formations routed into a riser exposed to two miles of low seawater temperatures can form hydrates and paraffins quickly, blocking flows or skewing test results. Analysis of prospective production will have to take this possibility into account. (Source: *Offshore*, March 1996)

New emergency towing system

A new design of emergency towing gear that requires no human action from a stricken ship has been developed by the Dutch anchor supplier Willem Pot, in association with Helwig & van der Laan Marine Consultants. The equipment is designed for fitting on the bow and/or stern of, nominally, a tanker, as this is the type of ship most associated with feared pollution accidents, although the bow of the ship is more attractive since it is normally strengthened for towing from the design stage.

Special equipment comprises a short length of chafing chain connected at the shipboard end to a shackle and strong point, and two 100 m lengths (red and blue) of messenger rope carefully stowed in boxes for pulling out and connected to a special towhook. Each end of the messenger lines is connected to short lighter lines leading through a fairlead and terminating in a special grab hook which is permanently mounted at the extreme forward end of the forecastle (or extreme aft of the stern) above the bulwark. All messenger lines are linked to form one continuous loop which is run through the first link of the chafing chain and includes the tow hook. The final item is a sloping cable fitted between forecastle masthead and forecastle bulwark.

Willem Pot's concept involves a rescue tug shooting a light rescue line with a weighted end across the stricken ship's bow. Extreme accuracy is not necessary since the weighted line will fall down the sloping cable until it engages the special grab hook, whose design secures it and prevents the weight being drawn through.

The tug's tow winch then pulls in the grab hook (designed to be pulled away) plus the two short and two long red and blue messenger lines—different colours are essential so that the crew knows which line to pull later. The blue line is then pulled until the towhook emerges through the ship's fairlead, then both lines are pulled and the chafing chain should follow. By pulling the blue line and releasing the red line, the tow hook will eventually arrive at the tug's winch.

All that is now necessary is to disconnect the blue line from the tow hook and attach a proper towing wire. By pulling the red line, the tow hook will return to the ship and owing to the hook's special design it will link automatically with the chafing chain; towing can then begin.

Practical tests have already been carried out in Singapore using a 33,600 d.w.t. JO Tankers chemical tanker JO *Clipper*, in association with the Dutch Shipping Inspectorate and Det norske Veritas. These tests were in harbour but at-sea ones were being planned with a different ship. (Source: *The Naval Architect*, March 1996)

New pilot positioning system from Israel

The *Sea Empress* pollution disaster at Milford Haven has highlighted the risks to which oil tankers can be exposed when entering harbour even when they have a pilot on board.

The pilot uses his local knowledge to guide the ship into port, mainly using visual navigation and his experience. There is a reluctance to use to use the electronic systems which are on board ship because the quality of the information may be questionable. However, a new system developed in Israel now allows the pilot to take his own electronic system on board with him to improve the safety of ship operation in the narrow channels of ports and harbours.

The new system, called Portray, has been developed by Oceana Advanced Industries Ltd. and is basically a portable electronic chart system which has been modified to provide the high-quality information needed to navigate a large vessel in narrow channels. Housed in a watertight case, the system is based on a 486 computer with an 80 MB hard disk and 8 MB of RAM.

The digitized charts for the particular harbour are held on the hard disk and can be updated to match the latest survey information. They are presented in full colour on the high-resolution colour LED display.

The position information is supplied by the Differential Global Positioning System (DGPS), this satellite-based system providing accuracies of 5 m when linked to the ground-based reference system. When the pilot boards the ship the GPS antenna is fixed in a clear position and a heading sensor unit is referenced by means

of the ship's own compass. The location of the ship's bridge in relation to its overall length is entered, which allows the ship to be displayed on the screen in true size scale.

From this point on, operation is automatic, and the pilot has a full-colour display of the progress of the vessel in relation to the channels and marks. Optimum tracks to follow can be pre-programmed on the chart so that any deviation becomes readily apparent at an early stage.

One of the key features of the system is that any sideways drift is indicated so that corrections can be initiated at an early stage before they reach serious proportions. Reports on the *Sea Empress* disaster suggest that it was failure to take early corrective action which was a contributory cause of the accident. Large ships generally have poor manoeuvrability, so early action to counteract drift is essential. Pilots are also using the Portray to monitor the approach into the berth where speed of approach is critical.

The Portray system is already in use in Israeli ports and trials are taking place in the Port of Rotterdam. This electronic aid to pilots can only help to make manoeuvring large ships a safer operation, and if it had been in use at Milford Haven it might have prevented the major pollution disaster. (Source: *The Dock & Harbour Authority*, April 1996)

Electrically conductive paint to prevent marine organism adhesion

Kansai Electric Power Co. Inc. and Mitsubishi Heavy Industries Ltd. have jointly developed an electrically conductive paint that prevents marine organism adhesion on the surfaces of thermal power plant water intakes.

This electrically conductive paint consists of a vinyl chloride resin containing carbon, and when a feeble electric current is passed through the paint, the seawater on the water intake painted surface is decomposed to generate hypochlorous ions. These ions act like the chlorine in faucet water and create an environment that prevents microbe adhesion on the painted surface. In addition, since only a very small volume of ions is generated which are readily decomposed in seawater, the paint does not pollute the marine environment.

Passing a feeble electric current of 0.1-0.2 A on the wall surface has been confirmed to repel or prevent the adhesion of marine organisms such as barnacles and hard-shelled blue mussels. In addition, the paint contains no harmful substances such as copper or organic tin, so does not pollute the sea.

At the Aioi Power Plant, the new paint was used in tests for 14 months. Whereas marine organisms adhered densely on water intake walls not coated with the paint, hardly any were found on the wall surfaces coated with the new paint. As a result, the usual water intake cleaning frequency of once a year can now be extended to once in two years.

For more information contact: Kansai Electric Power Co. Inc., Public Relations Dept., 3-3-22, Nakanoshima, Kita-ku, Osaka City, Osaka, 530-7. Tel.: +81-6-441-8821; Fax: +81-6-444-1369. (Source: *JETRO*, April 1996)

New fire protection system from Thermal Ceramics

Thermal Ceramics has released details of new fire protection systems for fast ferries that, it says, "build on the existing range of Firemaster X607 blanket profile wrap systems for bulkheads and decks which now provide A60 fire protection to aluminium hulled ferries".

The company reports that it has recently been working with shipyards and contractors to develop new fire protection solutions which meet present and future needs of the fast ferry industry.

One result of this has been the development of the Firemaster Alu-Clad range. Originally produced for Mjellem & Karlsen's first 95 m monohull, *Kattegat*, Thermal Ceramics says that Alu-Clad offers weight savings of up to 50 per cent compared to traditional profile wrap methods of structural fire protection, achieved by running the insulation flat under the structure instead of wrapping the whole surface area. The resulting savings in area of material installed provide an associated weight saving overall.

According to Thermal Ceramics, the Alu-Clad system has good flexibility in installation as it is fitted *in situ* rather than prefabricated and then assembled on the vessel. Awkward areas can be easily accommodated as the installation progresses, eliminating major pre-installation design work.

Further development of the concept has resulted in the launch of Alu-Clad II. This is based on the original concept, but incorporates an air gap between the insulation and structure through which services can be run. Alu-Clad II is currently being installed for car deck fire protection on the Seajet vessels under construction at Danyard. (Source: *Fast Ferry International*, April 1996)

Solar-powered equipment for Canary Islands

Tideland Signal Ltd. recently won a second contract to supply solar-powered equipment for a project in the Canary Islands.

The company supplied the island's first solar-powered buoys in 1992, when they were used to mark submerged telephone cables. Because of their performance and reliability, the major Spanish utility company, Fomento de Construcciones y Contrates (FCC), chose Tideland lanterns and buoys, this time to mark an underwater pipeline offshore from Las Palmas on Gran Canaria.

The point where the pipeline enters the sea is indicated by a Tideland ML-155 lantern, mounted on a 6 m high steel pedestal with a special yellow X topmark. Two SB 2.5 M skirt-type marker buoys, each with an ML-140 lantern, mark the path of the pipeline. All the lanterns have a range of five nautical miles under normal atmospheric conditions.

The ML-155 lantern is fitted with a TF-3B MicroPower multi-code flasher/lampchanger. Solar power for the pedestal lantern is provided by SSV-6L solar module assemblies, while the buoy lights are powered by SSVB-12LU units. The solar arrays gather and store energy during the day, even in very low light conditions, to power the lantern at night. (Source: *The Dock & Harbour Authority*, April 1996)

New VTS system STN ATLAS Elektronik

STN ATLAS Elektronik has extended its 9730 range of Vessel Traffic Services Systems (VTS) with the introduction of a new low-cost, standalone assembly meeting IMO and IALA VTS recommendations, the Atlas 9370-A. This has recently been purchased by the Swedish National Maritime Administration to monitor traffic in the Flintrannan Channel.

Capable of automatically tracking more than 300 targets at any one time, and incorporating electronic sea chart facilities with integral editor functions, the system comprises either an X- or S-band remote control Atlas

radar with variable antenna sizes, a radar data processor with a high resolution raw data scan converter, and an operator workstation consisting of a keyboard-controlled 21 inch colour monitor together with support software.

Simple to install and operate and featuring low running and maintenance costs, the system is designed for manual and automatic target acquisition with measurements presented in latitude/longitude and range/bearing coordinates. Operational parameters provided include collision alerts, fairway supervision, speed alarms and anchor watch, as well as buoy and navaid drift alerts.

Window-type display functions typically comprise overlays of raw radar data together with synthetically-generated information such as track data, symbols and electronic charts; selective enlargement of specific traffic situations is also possible. (Source: *The Dock & Harbour Authority*, April 1996)

Foam tube boats from US Marine

US Marine of New Orleans is a major builder of patrol and workboats. Its first rigid inflatable was built for the requirements of Trinity Marine for use on the series of large pollution-control vessels which Trinity has built.

The design of this foam tube boat has now been refined and is being marketed as a practical workboat. The hull of this 21 ft vessel is moulded in glass-reinforced plastic (GRP); US Marine makes its own tubes from a hollow polyurethane foam which is sheathed with an abrasive-resistant sealant and then fitted inside a hypalon fabric sheath.

By using a hollow tube and a resilient foam, the tube has a degree of shock absorbing capability and the double skin protection allows it to stand up to hard workboat use.

The design has been kept simple with a one-person stand-up console with a matching bolster support. A towing post is fitted behind the bolster and a wire mesh guard protects the helmsman in the event of a towline breakage.

Power is provided by a single 130 hp Volvo Penta diesel coupled to a Volvo Penta Duoprop drive which gives speeds in the 30 knot bracket. Lifting points are fitted for use when the boat is operating from a mother ship. (Source: *The Dock & Harbour Authority*, April 1996)

New aluminium boat for Biscayne Bay pilots

Gladding-Hearn, based at Somerset, Massachusetts, has handed over *Vizcaya*, a new pilot boat, to the Biscayne Bay Pilot Association. This is of all-aluminium construction and the hull is of deep vee hard chine design, 15.9 m overall.

Main engines are Detroit Diesel 8V-92N, each rated at 271 kW and driving a conventional four-bladed propeller via Twin Disc gears. Top speed is 22 knots.

Metal sheathed acoustic insulation is fitted under the deck and against the engine room bulkheads. In addition, a sound-absorbing air intake system, special engine mounts and a hospital grade exhaust silencer system further reduce the sound. (Extracted from *The Dock & Harbour Authority*, April 1996)

Cyclone tubes yield oil-free water

A lightweight hydrocyclone tube from the UK's Vortoil Separation Systems Ltd. was designed as a small, high-capacity separator to clean up oil spills. The device is now being used to treat large volumes of water on oil rigs. The tube use vanes to convert kinetic energy of the flowing liquids to centrifugal force, almost instantaneously separating the oil and water. Vortex action inside the tube causes lighter liquids to flow in the opposite direction to the denser liquid. Clean water and recovered oil exit at opposite ends of each tube. On one North Sea platform, a unit containing 19 cyclone tubes processes about 200,000 barrels of water daily. (Source: *Machine Design*, 9 May 1996)

Composites replace steel in major subsea structures

The latest from Seanor is a new generation of subsea covers. Composites have entered the arena of large-scale offshore engineering.

Those futuristic composite designs which first took shape in the early 1990s are fast becoming engineering realities for the offshore industry. It seems that composites are slowly dismantling the structure of steel and concrete on which offshore exploration has been built. Take Maritime Seanor's subsea oil well covers, arguably one of the biggest items of metal replacement engineering to move into offshore production.

The covers, traditionally made in steel and concrete, protect the oil wells from damage. Seanor, the first company to develop composite versions, is now under contract to supply Saga Petroleum in the Vidgis field of the North Sea.

Composites outperformed steel in terms of strength and weight, according to tests carried out by Seanor, Norway's Bureau Veritas and Stockholm Technical University. Coupled with the 20-30 per cent lower manufacturing costs, composites emerged as clear winners in the offshore industry's cost-benefit analysis.

Not only is the entire structure smaller, and lighter by some 40 per cent, but manufacturing, transportation and installation are reportedly much simpler. Each cover is based on a sandwich construction—PVC foam core panels between layers of glass reinforced plastic. The design impact level is 10 kJ at any point in any direction. The absence of stiffeners and girders also enables a simple shell design construction.

More specifically, composites lowered the weight and size of the template, allowing transportation out to sea with relatively small construction vessels. The structure's lower size and weight, a mere 50 tons, make for easier installation on the ocean floor; the covers can be easily opened for maintenance and inspection; finally, composites resist the chemical and corrosive environment of the sea water. (Extracted from *Advanced Materials News*, May 1996)

Kvaerner FSSL integrates control of Andrew operations

BP UK's Andrew Field, due to be in service in the summer of 1996, will feature the first integrated control, monitoring and safety system (CMSS) for both platform and subsea installations. The system, designed by the Industrial Computer Applications (ICA) division of Kvaerner FSSL, Aberdeen, is based around a common Siemens hardware platform comprising PLCs for control and PC operator stations. Andrew's control requirements have also been configured using Siemens' Applications Productivity Tool (APT), designed specifically for control systems and covering activities from PLC programming to man-machine interface.

APT allows the user to implement process control needs rapidly in a structured and object-oriented manner. It provides seamless integration between PLCs and the

operator interface as well as a common programming tool across all applications, whether process- or safety-related.

The CMSS handles the entire process-control functions on the Andrew platform as well as the subsea control functions on the Cyrus field. Its role is to monitor the process characteristics, keep them within prescribed limits and provide operators with status reports. This covers all process packages.

The Emergency Shutdown System (ESD) monitors platform process conditions and initiates an orderly shutdown when hazardous conditions are detected; manual initiation is also possible from the central control room or drilling module. It also isolates reservoir risers and major inventories and depressurizes gas inventories. The aim is to prevent process plant failure, hydrocarbon release or catastrophic failure, and to limit the inventory exposed to potential hazard.

The Fire and Gas System (F&G) monitors the plant for the presence of fire and gas, initiates the release of extinguishant and provides audible and visual indications of a hazard. Fire water ring main and fire pump control logic is also incorporated in the system, including a dedicated hardwired mimic on the F&G matrix panel.

Each part of the CMSS—ESD, F&G and so on—is physically segregated and powered by separate power supplies. (Source: *Offshore*, May 1996)

Composites lighten superfast sailboat

A "flying-sailing" vessel called the Hydroptère is under construction in France by the Gallic firms Matra Défense of Velizy-Villacoublay Cedex, and Dassault Aviation of Caucresson. The craft, which incorporates both aeronautical and nautical technology, is being readied to attempt a series of record-breaking crossings of the Mediterranean Sea and the Atlantic and Pacific Oceans in 1997.

The boat is an 18 m long hydrofoil trimaran with the foils mounted under the sponsons between the hulls. When the vessel moves forward these foils are subjected to a vertical force that lifts all three hulls out of the water. Only the foils and rear stabilizers remain in the sea. At that time, say French engineers, the boat will have reached a speed of 10 knots (18.5 km/h or 11.5 mi/h). Very high speeds—for a sailboat—should then be possible thanks to the small wetted surface area and low hydraulic drag.

There are three main constraints to be overcome in building a boat like the Hydroptère. First, because the stress on the foils is as high as that applied to the wings of a combat airplane, it cannot be built using conventional materials or technology. Second, since the boat can only "take off" if its weight is very low, the use of a keel is excluded. The third major difficulty: achieving stability in a lightweight craft when it is subjected to high stresses.

To limit weight while optimizing rigidity, high-performance composite materials, such as carbon fibre and glass fibre-reinforced polymers have been chosen for the boat's foils, 27 m (90 ft) high main mast, central hull and 250 m^2 (2700 sq ft) of sail. To limit ventilation and cavitation, the foil shape was progressively refined through several hydrodynamic wind tunnel sessions using a one-third scale model.

For more information contact French Technology Press Office Inc., 401 N. Michigan Ave., Suite 1760, Chicago IL 60611. Fax: (312) 222-1237. Cite FTPO Reference No. 95-05-145. (Source: *Advanced Materials & Processes*, May 1996)

World's first through-tubing multilateral intervention system installed

The reasons for drilling multilateral wells are now well established with the resultant cost benefits and increased recovery. Drilling practice can side-track from horizontal sections in wells to increase formation exposure and to reach pockets of reserves which would not be economic for recovery from a dedicated well.

Accepting the above, there is still a considerable investment in time and money to drill and complete these multilateral wells. Therefore, to protect and service this investment there must be a requirement to manage the reservoir and ensure that its potential is realized.

Doing so involves gaining access at will to the well branches to:

- Monitor performance in all parts of the well;
- Perform stimulation work to assist production;
- Control production by means of isolation.

Multilateral re-entry system from Pressure Control Engineering Company (PCE) provides a means of:

- Gaining access to any lateral bore at will.
- Enabling coil tubing to perform any of the functions above without the use of a drilling rig;
- To do this through the restrictions of an upper completion at any time during the production phase;
- Hydraulic isolation of lateral bores.

Four main criteria need to be addressed when designing the system:

1. All equipment for post completion re-entry would have to pass through the upper completion.
2. A means of diverting the coiled tubing into the lateral branch.
3. Somewhere for these through tubing tools to locate as most laterals branch out of the larger diameter lower liner section.
4. Whatever was used could not be permanent as access into the well with the rig at a later date might be required.

The solution was to provide a "sleeve" that would be run into the well after drilling and before the completion that would sit across the "window".

This sleeve, or MLR nipple, would have an outside diameter to suit the liner and an inside diameter the same as the upper completion. Setting this sleeve in a known position in relationship to the lateral bore exit point or window, both for depth and orientation, would allow deployment and location of tools with coiled tubing at the window.

The MLR nipple needs to be positioned for depth and orientation so that the diverter will accurately deploy the lateral access tools cleanly into the lateral bore. Tolerance for depth needs to be within parts of an inch and orientation within a few degrees. The best and most accurate way is to use the device employed to drill the lateral bore.

A latch collar as used by the directional drilling contractor is part of its casing-deployed lateral drilling equipment, and comprises two main components: a machined profile in a casing collar to give a depth and orientation correlation with a pre-machined casing window above. This window is then wrapped with GRP for easy drilling out.

The system is also flexible enough to allow for more laterals to be drilled from the backbone liner by using workover techniques, as it does not require permanent structures to be built into the well.

The PCE multilateral re-entry system was successfully installed in February 1996 and in so doing became the world's first successful installation of a through tubing multilateral well intervention system. (Extracted from *Offshore*, May 1996)

Expert-on-line remote maintenance reaching stride

The use of satellite video and data transmission to move images and information makes it possible to troubleshoot problems and maintain equipment without having to transport experts out to remote sites. For several years now, Wartsila of Finland has had the ability to tap into individual diesel engine data monitors around the world, troubleshoot a problem, and move replacement parts to the location from the nearest supply facility. If a video of the problem area is needed, then the images can be transmitted. If a site engineer needs a parts catalogue on line, that can be brought on-line, occupying just a portion of the video picture.

Emergency medical care is another beneficiary of satellite video consultation. Video images with attached vital signs of patients or injured persons can be transmitted to physicians at medical facilities thousands of miles away. This allows the best medical help to be brought on-line quickly.

Manufacturers are beginning to send equipment and systems out with condition monitoring computers built-in. At any point in the preventative maintenance cycle or following a problem, on-site workers can plug a device into the computer to spool the real-time or accumulated data and transmit to a service centre where experts are standing by.

The process frequently eliminates the initial service call, allows untrained workers to assist in troubleshooting, and sends the repair crew to the site with the right replacement parts and equipment. (Source: *Offshore*, June 1996)

Virtual reality used to inspect riser tunnel under Troll

Using a simulation program and a live remotely operating vehicle, Norske Shell will use virtual reality to inspect parts of its riser tunnel system at the base of the Troll gas platform. The risers enter the platform at a depth of 620 feet through long risers. The remotely operated vehicle will be guided by the software through the tunnel area, and the live film will be superimposed on a computer-generated model of the tunnel. The result will be a graphic replica of the site and the exact location of leaks or other problems. (Source: *Offshore*, June 1996)

Sixth generation drilling units will incorporate many design changes

The sixth generation mobile offshore drilling unit will probably contain some drastic changes in both appearance and structure from earlier conventional rigs. Judging by the research under way at present, and the needs of drilling contractors, one can expect some or all of the following:

- **Multi-functional:** The units will incorporate the ability to readily load on and load off skid-mounted equipment to conduct complete well site operations (rotary and coiled tubing drilling, production, extended well testing, workover, and installation of subsea and pipeline production equipment).
- **More compact:** Reductions of size and weight will provide a more compact unit, but because of environmental forces, the footprint and freeboard for both jackup and semisubmersible units are unlikely to change much.
- **20-25 per cent less weight:** Modular on-and-off movement of equipment to accommodate changing functions will keep deckweight down. New lightweight fire-blast walls, lower accommodations requirements, and wider use of composites will also help.
- **Fewer people:** Two-person drilling crews and fewer contractor personnel armed with a wide array of computers and video communications gear with experts on line will keep crew numbers down.
- **Reduced mast:** Hydraulic push-pull systems will replace the conventional derrick and draw-works (see following article), reducing the mast sail area (surface area exposed to overturning forces).
- **Lower centre of gravity:** In addition to a minimized superstructure and drill floor mast, multiple pipe sections will be racked below the drill floor full time and only laid horizontally for testing purposes.
- **Reduced keel and draught:** Reducing the superstructure, mast, sail area, and lowering the centre of gravity will allow designers to focus keel and draught shape for maximum storms instead of drilling.

(Source: *Offshore*, June 1996)

Key technologies of the future cited

An insight into what technologies drilling company managers see as useful in the coming years was provided recently by Sonat Offshore Drilling, at the Oilfield Breakfast Forum in Houston. The key technologies outlined include:

- Hydraulic lifting systems to replace the derrick, motion compensator and draw-works;
- Under-balanced drilling with concentric drill- strings;
- Subsea under-balanced (riserless) drilling;
- Total fluids management;
- Hydraulic directional jet drilling without cutters;
- Drilling with casing;
- Coiled tubing drilling;
- Reliable composite materials for tubulars, mooring systems, casing and risers;
- Multilateral completions;
- Designer wells.

(Source: *Offshore*, June 1996)

SWATH rig may use casing for riser

Statoil is considering the use of casing in place of a riser for its swath-shaped well intervention and slimhole drilling vessel now nearing the fabrication stage. The vessel hull is a Single Water Plane Twin Hull unit (SWATH), which has the stability of a twin-hulled semi-submersible drilling unit but can transit from one location to another as a ship would.

The use of casing as a riser would save a great deal of cost, weight and storage area on the SWATH unit. Such a system would allow deployment of a blowout preventer on the seabed and at the surface. When experiencing a blowout or kick, both stacks can be closed and the gas circulated out within the top casing while maintaining well control downhole. (Source: *Offshore*, June 1996)

FLASH superminiature, lightweight underwater TV robot

Q.I. Co. Ltd. has added the superminiature lightweight Fish Man FM-3000 unit to its series of underwater TV

robot systems and has expanded the models of other TV robot systems.

The new TV robot uses a joystick with an accessory 4-inch colour liquid crystal display monitor to perform operations by remote control, and can move about freely in water depths of up to 50 m. The system consists of the robot, a joystick, a power source box and a main cable accommodating box. The robot is applicable to a broad range of tasks, such as surveys of fish shoals, bridge girders and water storage tanks.

The underwater TV robot incorporates a 1/3 inch charge coupled device (CCD) colour camera. The robot weighs two kg, and uses three thrusters for moving about underwater at a speed of 15 m/min. The robot and joystick can be accommodated in the accessory power unit box (total weight—about 25 kg).

For further information contact: Q.I. Co. Ltd., International Business Dept. of Technical Center, 2-4-7, Fukuura, Kanazawa-ku, Yokohama City, Kanagawa Pref. 236. Tel.: +81-45-783-1035; Fax: +81-45-785-0120. (Source: *JETRO*, June 1996)

Egg cracks tanker safety

By Nick Savvides

Safer, cheaper oil tankers appeared to come a step nearer this week when the "Coulombi Egg", a radical new design, was approved by the International Maritime Organization (IMO) on 2 July 1996. Swedish naval architect Anders Bjorkman, inventor of the Egg, believes his design could revolutionize tanker safety by eliminating many of the problems associated with competing designs. He named his invention after Columbus' legendary egg, which stood on its tip after being broken at one end, proving the impossible could be achieved.

Following the Exxon Valdez disaster in 1989, double rather than single hulls became mandatory for tankers sailing in US waters—a unilateral move that causes consternation in maritime circles. At the time, IMO left the door open for other designs provided they offered as much protection as double hulled tankers (DHTs).

Yet although it is superior in many ways, and despite its IMO approval, the Egg is unlikely to gain widespread recognition in the face of opposition from the US. Unlike a DHT, a tanker based on the Egg design has a number of small tanks, containing oil at a lower pressure than the external sea water. This means that if the hull is breached, water flows in rather than oil flowing out. And, since oil floats on water, as the water fills the tank the oil is pushed up through access trunks and is automatically transferred into the ship's empty ballast tanks.

A major problem with the DHT design for naval architects is posed by the void space between the two hulls, which is also used for ballast when the cargo holds are empty. An accumulation of highly inflammable hydrocarbon gas, emitted from the cargo and trapped in the cavity, can cause an explosion. To prevent explosions, an inert exhaust gas is pumped into the cavity, but this creates other problems. Sulphur in the gas mixes with water and hydrocarbons from the cargo to create a dilute sulphuric acid that corrodes the ship's structure like a cancer. Screening for corrosion becomes a hit-and-miss affair in a cavity which is small (up to three metres wide), dark and very dirty, with dust and accumulated sludge from the ballast. The Egg does not suffer from any of these problems because it has only one hull.

The Egg also performs better in collisions. According to IMO statistics, around 70 per cent of collision damage is sustained above the water line. With this in mind, ballast tanks were placed on the upper section of the vessel. The tanks act like a crumple zone and absorb the impact. The lower storage tanks, if breached, automatically transfer cargo to the ballast tank on the opposite side of the ship.

And, unlike a DHT, the Egg is built to flex in heavy weather. Very Large Crude Carriers (VLCC) crack if they are too rigid, snapping like a dry twig. The design of the DHT, with supports holding the outer hull in place, makes the ship inflexible.

But in spite of its obvious advantages, the Egg design may end up grounded in a bureaucratic dry dock. A similar fate befell the Japanese "mid-deck" design, also approved by IMO but, despite assurances from the US that it is open to new designs, has yet to be approved by the US Coast Guard.

The designer claims that if the *Sea Empress*, the single-hulled vessel that ran aground last month, had been a double-hulled tanker, the oil spill in Milford Haven might have been worse. He further argues that the cavity between the two hulls would have filled with sea water, adding up to another 25,000 tons in weight, and fixing the ship to the rock like a beached whale. The constant pounding of the water would probably have resulted in the ship breaking apart, spilling even more than the 70,000 tons of oil now washing up on the beaches.

But while the Egg may never trade in the US, the world's biggest oil market, the designer hopes to persuade some Japanese shipyards to build vessels based on his design because they would be 10 per cent cheaper to build than equivalent DHT or mid-deck designs, and could ply the Japanese oil trade routes unimpeded. (Source: *Guardian OnLine Technology*, 3 July 1996)

Remotely operated chain stoppers make debut on production tests

The offshore version of Kockums Submarine System's chain stopper has found ready acceptance. The Double Acting Bow Chain Stopper is both remote controlled and releasable under load—hence the acronym RC-RUL. It comes complete with a self-powered hydraulic system.

The chain stopper, which weighs 4.9 tons with the hydraulic system, is intended for use with K4 anchor chain of 84-92 mm. It has been approved by Lloyd's Register after passing a 300 ton load test. Kockums began looking at ways of enhancing its chain stopper design several years ago at the prompting of Det norske Veritas. A unique feature of the Kockum's design is that it allows only pressure forces, and not bending forces, to work, thus making for better handling qualities.

The new version incorporates these features but has undergone further development to meet offshore requirements more closely. Instead of cleats, it employs two levers to lock the chain in position. Cleats are more appropriate to ships with a windlass to take the load before the stopper is released.

The hydraulic system is also new, and provides a safer and more efficient means of releasing the load under emergency conditions. The chain stopper has its own pump and motor so that it can also be released by hand. The previous version was hand-operated only.

For more information contact: Kockums Submarine Systems AB. Fax: +46 40 34 87 61. (Source: *Offshore*, July 1996)

World's first man-made marine ridge for fish cultivation

Hazama Corp. is building a marine ridge to serve as an artificial fish habitat off the coast of Nagasaki. The project is commissioned by research organization Marino Forum 21, which focuses on simulating coastal fish environments. The project will demonstrate the effectiveness of man-made reefs in attracting fish.

Around 50 per cent of the world's fishable stock is concentrated in sparse ocean areas with upwelling current—no more than 0.1 per cent of the total sea area. Such conditions cause abundant deep-sea nutrients to rise to the level of sunlight penetration, promoting the growth of plankton. This stimulates the food chain, ultimately resulting in more fish. An artificial reef should produce such an upwelling current.

Using conventional methods, it is extremely difficult to create a shallow fishing ground in deep seas. In this project, a mound with the shape and function of a natural reef is formed by bulk-loading 4.1 m^3 high-density blocks. This method realizes efficient systems for processing, loading, transporting and installations at low cost.

The reef is being built off the coast of Hokushou at a depth of 80 m. It will be 13-14 m tall, 50-60 m wide, and 130-140 m in length. The reef will be constructed from 5,000 concrete blocks of 4.1 m^3 in size, made from a coal ash by-product from the Matsuura Thermoelectric Power Plant. The project therefore has environmental spin-off benefits and enhances relations between the fishing and power industries.

For more information contact Hazama Corporation, Corporate Communication, 2-5-8, Kita-Aoyama, Minato-ku, Tokyo 107. Tel.: +81-3-3045-1110. Fax: +81-3-3478-4674. (Source: *JETRO*, July 1996)

Multi-directional Sea Twin to patrol Troll landfall tunnel

A prestige offshore reference has been won by Sutec, the Bofors group company which supplies inspection and light work ROVs. The company's Sea Twin vehicle has been specified for the inspection system developed for the Troll gas landfall tunnel.

This is a ground-breaking project—the tunnel is about 4 km long and in a water depth of up to 240 metres. The first inspection was carried out this summer. Whether being used for offshore or other purposes, the ROV has been developed mainly for diving from the surface to its workplace. Some re-thinking was necessary for it to be able to travel the long distances in the horizontal mode required for tunnel inspection.

A neutrally buoyant tether and supporting winch was developed by Dolphin Offshore Contractors to replace the conventional tether, which would be too heavy for an ROV to drag behind it for any distance.

Even so, a powerful machine was required in order to reach the farther parts of the tunnel, and Dolphin's choice was Sutec's Sea Twin. This vehicle develops a thrust power of 2,500 newtons.

The Sea Twin is also highly manoeuvrable, enjoying unlimited movement in six degrees of freedom—it can operate in any direction, even upside down, under full control—and very stable in any attitude.

These capabilities are essential to the project, as the vehicle carries a sensor package developed by Dolphin, including four sonar systems, and has to be able to approach any part of the tunnel, whether sides, top or bottom, if a close-up view of a particular area is required. It is equipped with colour and SIT cameras.

The Troll tunnel inspection project opens up a new field of activity for ROVs.

For more information contact Bofors Underwater Systems. Fax: +46 13 15 13 20. (Source: *Offshore*, July 1996)

Around the world on solar power

A British woman is planning the first round-the-world voyage by a solar-powered boat.

Karen Howarth will in 1997 spend 205 days on her 45 ft catamaran circumnavigating the world via the Panama and Suez canals. She will not use sails. The boat will be powered only by energy collected from the Sun.

Howarth's boat, the *Global Green Cat*, will carry 58 m^2 of solar panels—enough to power eight electric motors at a top speed of 10 knots (11.5 mph).

Daily reports of her progress during the 26,000 mile voyage will be posted on the Internet, and Howarth, a television director, plans a satellite link to transmit television pictures from the ocean. She will carry out experiments to improve the understanding of global warming, ocean pollution and plankton populations. The silent boat is also ideal for recording the communications of whales and dolphins.

Howarth is making the trip to show solar power is a viable alternative to traditional fuels.

Howarth and her team have spent more than £150,000 on *Green Cat* and have attracted sponsorship and equipment from 37 companies and organizations. She is still seeking a sponsor that can afford £250,000 for the solar panels and voyage back-up facilities.

The record for the longest solar-powered boat voyage is 1,305 miles down the Murray River in Australia. A Japanese sailor, Kenichi Horie, is trying to cross the Pacific from Ecuador to Japan in his 31 ft solar-powered boat made out of aluminium recycled from 27,000 beer cans.

To smash all solar boat records Howarth must leave Weymouth in the early spring to avoid hurricanes and tropical storms around the equator. It will take 43 days to cross the Atlantic to Panama, another 73 to reach Darwin in Australia, 60 more to Suez and a final leg of 29 days to get back home.

Designing *Green Cat* has been a challenge in itself. Howarth has had to balance displacement and hull shape against solar-panel area, power output, battery capacity and motor efficiency. The balance was found with a boat 13.9 metres long and 7 metres wide, providing a 58 m^2 space to position the solar panels.

There are 20 main watertight compartments plus four huge sealed crossbeams, allowing Howarth to claim it is unsinkable.

To keep the weight down, holes have been cut out of surfaces wherever it has been safe to do so.

The photovoltaic solar panels will generate electricity, even under cloudy conditions. Any surplus power will be stored in batteries for use at night. In the event of a total power failure, Howarth has access to a mast and sails locked away and sealed by the World Speed Council, which will ratify her trip.

To find out more about her world record attempt, visit the *Green Cat* home page on the World Wide Web. It is at http://www.greencat.co.uk. (Source: *Sunday Times*, 4 August 1996)

Smoother sailing

Advanced designs and controls for ships travelling at up to 70 km/h offer attractive transport options and passenger comfort even in rough seas.

The jet age is arriving at sea. Today, new ships go into service with advanced hulls, power plants and control systems and haul people and goods to their destinations at 60-70 km/h or more—about twice as fast as conventional ships do. During the past five years, large ferries have benefited from advanced hydrodynamic analyses of hull shapes and from control technologies developed in the cancelled US "100 knot Navy" project (it was started in 1966 to develop surface vessels having at least three times more speed than normal surface combatants). Transoceanic carriers will soon be similarly blessed; currently, most cargo ships ply the oceans at 28-46 km/h, little faster than convoys during the Second World War.

The cost of the new fast ships will be offset by the fact that fewer of them will be required: Fast Ship Atlantic calculates that for a given amount of cargo delivered, eight of the new ships, travelling at 65 km/h (35 knots) or better, can replace 35 slower ships. Thanks to a novel cargo-handling system that is also part of the design, the new ships will unload and reload more quickly than their present-day counterparts. What is more, they will arrive on time, making it unnecessary to pay longshoremen to wait for ships to arrive.

Most of the new vessels exploit Archimedes' principle, namely, that an object is buoyed by the water it displaces. A popular variation is the catamaran, whose twin hulls make it more stable than single-hull ships. The principal alternatives are designs that raise ships either on a cushion of air or on hydrofoils to minimize water drag.

The first of the new generation ships to hit the seas was the HSS 1500, a 1,500 passenger catamaran built by Finnyards Ltd., Rauma, Finland, for Stena Line, Stockholm. Known as the *Stena Explorer*, the vessel went into service in March 1996 to ferry cars, trucks and passengers around the British Isles.

Eventually, the transatlantic speed record could go to Fast Ship Atlantic. The firm will soon ask shipyards to bid on a series of freighters that should put cargo on a four-day service from North America to Europe. Other fast cargo ships, such as Japan's Techno-Superliner and Kvaerner Masa-Yards' Euroexpress 2000, await buyers before they can move from the drawing board to the shipway.

Propellers on ships, as on airplanes, are curved in such a way that motion through water reduces the pressure on the blade's forward surface, whereupon the higher water pressure on the aft face pushes the ship forward. Making a ship go faster is not just a matter of spinning its propellers more quickly: because water drags on the hull of a ship, the energy needed to boost its speed rises by the square of the speed. Brute strength alone cannot overcome such viscosity.

Propeller design is a sophisticated engineering discipline in which each propeller is matched to a ship and its mission. Tugboats, for example, have large propellers to give the boat traction in the water while pushing large loads. Submarines have special propellers for ultraquiet patrols. A freighter's propellers are designed for the best blend of fuel economy at speeds around 37 km/h. If a propeller rotates fast enough and if the blades are positioned at the wrong angle—vacuum pockets form on the trailing edge. These pockets, called cavitation, reduce the efficiency of the propeller and, as they collapse, cause severe vibration that can damage a ship's power train. This consequence limits most ships to speeds below 56 km/h. (Source: *IEEE Spectrum*, August 1996)

Shuttlecraft flourish down under

Increased demand for ferry service in the waters of Northern Europe spawned the HSS 1500 ships. Ferries had been limited to a few hundred passengers and to about 100 cars and no trucks. Ferry rides were usually rough, making for seasick passengers—especially in the rough weather common in the North Sea, with its 5 metre high waves in winter.

A 125 metre long, 40 metre wide HSS 1500 ship carries as many as 375 cars on a roll-on/roll-off deck or else a mix of 100 cars and 50 trucks on a platform spanning two hulls. The hulls are partly submerged to lend them more stability than is possible with conventional single-hull designs. Passengers ride one deck above the hull, in an area with an immense restaurant, a lounge and a duty-free shop. There are no sleeping quarters, because voyages last a few hours at most. Aluminium is the chief material in the HSS 1500; composites reduce the weight of its wedge-shaped prow, the bulbous tips of each submerged hull, and several other sections of superstructure.

The *Stena Explorer* can make the run from Holyhead, Wales, to Dun Laoghaire, Ireland, in just 99 minutes—half the time needed by a conventional ferry. Its speed can reach 74 km/h. Since the ship can be unloaded in just 10 minutes and reloaded in another 10, a round trip takes less than four hours. Other routes will link Scotland to Northern Ireland and (in three hours) Britain to the Netherlands.

Although Scandinavian companies developed and marketed the first catamaran ferries, the concept has developed most rapidly in Australia. Small catamaran ferries appeared almost three decades ago to carry passengers from Australia's east coast out to the Great Barrier Reef and back in a day.

By the 1970s, the catamarans were being sold in Singapore, Hong Kong, and the rest of Asia (where water transport is important to the economy) by such companies as NQEA; Incat Designs Pty., Sydney; and Austal Ships, Henderson, Western Australia. In fact, the HSS 1500 has taken the size record away from the Hayabusa, a Japanese wavepiercer built under licence from Advanced Multihull Designs, Sydney, Australia. (Source: *IEEE Spectrum*, August 1996)

Fast ships cross the Atlantic

Much as Boeing got around the problem of aircraft maintenance and turnaround by putting more reliable jet engines on aircraft, so, too, aims FastShip Atlantic. Six LM 6000 jet turbines from GE Aircraft Engines, Cincinnati, Ohio, will power six water impellers that push FastShip's vessels at 74 km/h or more. As in popular jet skis, the impellers will suck water from under the hull and squirt it out of the stern.

The key is the hull, which looks like its conventional counterpart but behaves quite differently. A hull was designed where the rise in drag against the water is constant with speed, rather than exponential. Because of drag on the hull, a ship needs four times the power to double its speed. FastShip's design, validated in laboratories at the Massachusetts Institute of Technology, shapes the bow and the stern to keep the ship from settling as speed increases.

On ships, the turbine's axle extends aft into a geared mechanical transmission that connects to the shafts of the six impellers. This arrangement resembles the HSS 1500 configuration but does not use the same father-son arrangement, in which a turbine is coupled through a gearbox transmission system to another, less powerful turbine on the same shaft. Jet exhaust is vented through a vertical duct rising near the engine's rear. The transmission, in turn, drives a shaft extending into a water tunnel that starts at the bottom of the side of the hull and turns to let the shaft enter at a right angle. The shaft connects to an impeller that propels water at high speed through a nozzle at the stern. Water is driven into the duct first by outside pressure and then by the ship's forward motion.

The nozzles have doors that close over the ports to direct the water jet forward and thus slow a ship or move it backwards, much as a jetliner brakes itself with thrust reversers after touchdown. To give the crew flexibility and precision in steering—so much, in fact, that some naval architects think the ships will reach their berths without the aid of tugboats—each nozzle can be aimed in a separate direction.

One of FastShip's competitors will be the FM 130 fast monohull (single-hull) under development by Blohm+Voss, Hamburg, Germany. The hull is similar to FastShip's, but the FM 130 will move at only 53 km/h; a larger ship, for 1,500 passengers and 100 cars, is planned. In an unusual design move, the ship's two propellers are offset, with one slightly ahead of the other, so the second screw takes advantage of the first screw. This arrangement will be 15 per cent more efficient than two propellers in a conventional side-by-side configuration. (Source: *IEEE Spectrum*, August 1996)

Cruise control

Seasickness does not kill; it just makes the victim wish it did. To reduce motion that would nauseate people, fast vessels require a ride-control system to sense changes in motion and counter them quickly. Maritime Dynamics, Lexington Park, MD, supplies 90 per cent of the world market for such controls.

Maritime Dynamics grew out of the US 100 knot Navy project. The 100 ton SES 100B surface-effect ship testbed, which Maritime Dynamics designed, came close—170 km/h—but in 1980, the service cancelled the project in favour of moderate-speed, multipurpose warships. Many of the project's engineers and naval architects then entered the new civilian arena for high-speed ships.

Maritime Dynamics now builds controls to match individual ships. It produced the first truly effective catamaran ride-control system on the *Condor 9*, a 49 metre long, 450 passenger wavepiercer. The company was asked to refit the ship with controls after initial service across the English Channel in 1990 left passengers seasick. Usually, the control systems use an Intel 80C186 central processor that recalculates ride conditions up to 400 times a second. The system handles 32 data channels and 16 command channels.

Ride controls not only mitigate synchronicity but also stabilize ships so that they avoid movement in the 0.1-0.5 Hz range, "where you have to be a tough old salt" not to get seasick. On most large catamarans, the frequencies of resonant pitch and roll motions range from 0.1 to 0.3 Hz—and that is also the range in which human beings are most susceptible to motion sickness.

The choice of a control device is determined largely by the vessel's design. Monohulls and catamarans use steerable fins located along the hull-like extra rudders or inverted T-foils—small wings (standing clear of the hull) that act like the elevators on the trailing edge of an aircraft wing to push the bow up or down. Hydrofoils have control surfaces, akin to the ailerons on the trailing edge of an aircraft's wing, that counter sea motion by nudging the ship left or right. Air-cushion vehicles use vents, fins or foils to spill air out of the air cushion and to maintain constant pressure and minimize vertical acceleration. (Source: *IEEE Spectrum*, August 1996)

The challenge of scaling up

One challenge faces all naval architects: scaling up to full-scale operations the data generated by instrumented hull models towed in test basins. Although models can predict how a hull will behave in water, the forces on control surfaces do not scale in the same way.

The results of testing such appendages as fins, foils and rudders can be misleading, so for these devices Maritime Dynamics prefers to rely on proved analytical approaches and full-scale test results.

As an alternative, architects can build test models that are large enough to accommodate crews and thus obtain more realistic data at sea. Japan's Techno-Superliner project did just that with seagoing models of the Hayate TSL-F and the Hisho TSL-A70. To measure whether or not their control systems responded as planned to sea conditions, these ships were heavily instrumented. Inputs include the vessel's height above the waves as measured by two ultrasonic sensors to average wave heights; pitch and roll angles measured by two gyroscopes; pitch, roll and yaw rates measured by three optical-fibre gyroscopes; and speed in three dimensions, measured by accelerometers. Data were sampled every 10 milliseconds. The ship also had a speed sensor and a gyrocompass. To provide full redundancy for safety, an operational ship would probably have two sensors of each kind.

The HSS 1500 was designed for passive control, although Maritime Dynamics indicated that the fast ferry industry is waiting to see how the HSS 1500 performs, especially as regards ride quality. Expectations that the amount of motion on ships would decrease as their size went up have not been realized. The HSS 1500 is large as compared with the waves it will encounter in the waters between Ireland and England, and it has a hull shaped to counteract roll and pitch—at the expense of higher building costs and water drag. (Source: *IEEE Spectrum*, August 1996)

Integrated controls

The drive to achieve high speed and a smooth ride has been accompanied by a need for more complex control systems to measure more parameters than ever before and to control more gear for propulsion, steering, ballast and environmental control. To reduce operating costs, the designers of the new ships are doing what ship designers in general have done: they are turning to integrated bridge-control systems that can be steered and controlled by a single person. In addition, the engine room can be controlled automatically from the bridge, so no engine room crew at all is needed. The HSS 1500's system meets the strict one-man criteria of Det Norske Veritas, Norway's ship classification society—one of the world's most rigorous.

Kvaerner Ships Equipment, Tranby, Norway, supplied the control system for Finnyard's HSS 1500. With its high-tech design, the bridge looks like a cross between

television's Starship Enterprise and NASA's Mission Control. Steering takes place at a pair of redundant computer consoles placed beneath the forward-looking windows on the bridge. The two positions include a pair of Kvaerner electronic chart-display information systems (ECDIS), which combine electronic navigational charts, radar and Global Positioning System (GPS) data to produce an accurate computer image of the ship's position and course.

Manoeuvring and steering controls are located on a centre console; computer controls and a trackball are on the handrest, so they are always within easy reach of the operator. An overhead television panel shows views selected from 57 closed-circuit TV cameras around the ship. At the end of the console, there is a global marine-distress signalling and safety system, which replaces the old telegraphed SOS signal. The track and autopilot system lets the ship stay within 1 metre of a plotted course as it sails through the narrow Holyhead channel at 22 km/h.

At the centre of the control scheme is the Damatic XD integrated monitoring and control system, built by Lyngso Marine, in Drammel, Norway. Using a design that is becoming standard for large vessels, it brings together control systems for propulsion and manoeuvring, electric power, controlling the environment from air conditioning to sewage, fire detection and fire fighting, damage surveillance, and ship balancing by shifting fuel oil and water ballast.

Yet another science fiction blueprint for a ferry is the Euroexpress 2000, designed by Kvaerner Masa-Yards. This ferry has a sharp "whale back" bow that resembles the tail of a humpback whale: it curves down into the sea rather than rising forward as in other ships. The shape is designed to pierce waves and reduce loads on the vessel and its cargo as it makes the Finland-to-Germany run in 18 hours, about half the current transit time. Like the HSS 1500, the 225 metre long Euroexpress will be powered by two turbines from Kvaerner Energy and use an integrated bridge from Kvaerner Ships Equipment.

The engines of Euroexpress will be mounted in the whaleback bow, where they will drive two electric generators. These, in turn, will power electric motors driving propellers in the stern. The approach has two advantages. First, it helps ballast the bow, often left relatively empty, so that it ploughs through waves efficiently rather than heaving up and down in heavy seas. Second, it provides a long, clear volume in the rest of the hull for trucks to roll on and off.

Defining terms

Active control: a system that counters the impact of waves by moving a ship's control surfaces.

Ailerons: control surfaces on the outboard-trailing edges of an aircraft wing; when they move up, the aircraft moves down, and vice versa.

Catamaran: Tamil for "wood tied together"; a boat comprising two water-displacement hulls joined by a deck or struts.

Cavitation: the formation of vacuum bubbles on the surface (e.g. of a propeller) when it moves through water faster than water can flow into the gap it leaves; this uneven pressure makes the surface vibrate and erodes it.

Drag: the frictional force between two objects moving past each other; for example, between a ship's hull and the water around it.

Integrated control system: a control system that gives a ship's watch officer (who has the duties of helmsman and engineer) a single, easily managed overview of the data returned from sensors and operating equipment throughout a vessel.

Inverted T-foil: a movable T-shaped structure mounted beneath a hull. The cap of the T pivots about an axis (perpendicular to the ship's line of travel) to force the hull up or down in response to changing sea conditions.

Louvers: air vents, akin to the louvers in an air-conditioning system, that release or retain air in the bubble supporting a surface-effect ship or an air-cushion vehicle.

Monohull: a ship with a single hull employing Archimedes' principle—the displacement of water—to float.

Pitch: rotation in a ship from bow to stern (that is, bow movement up and down).

Roll: rotation occurring in a vertical plane (the deck rises left and then right).

Virtual reality: computer images and displays that give operators the impression of walking through a design that does not exist in physical reality.

Wavepiercer: a special hull in which the lowermost point of the bow juts forward under the waves to anchor the hull in turbulent weather; the centre section has a deep V shape to divert waves that would slap the bottom of the boat.

Yaw: rotation in a plane parallel with the sea (bow movement left or right).

(Source: *IEEE Spectrum*, August 1996)

D. OCEAN RESEARCH

The ROV 6000: ready for research

The goal of the ROV 6000, an unmanned remote-operated vehicle designed for deep-sea observation, is to respond to detailed reconnaissance needs over vast areas. This state-of-the-art technology, which should be operational in 1997, will also be equipped with specialized modular "tools", enabling researchers to use it for specific programmes. Its capabilities will mean that the manned submersible, *Nautile,* will be reserved for missions requiring the presence of human beings.

The future 3.5-ton vehicle, linked to the surface by a 300 metre leash and an 8,500 metre electrical cable, will have six propulsion motors and three video cameras covering a field of 180°. It will be capable of intervening for three days at a time, with one day of maintenance between dives, thus increasing cruise capacities.

Three specific scientific tool-kits will be available:

- The "route-measurement" module will enable the inspection of a zone covering several square kilometres, to be used for map-making and the inspection of rift valleys;
- The "sampling" module will gather fluids, sediments, rocks and fauna and will be equipped with a "changer", capable of employing different grips during any mission;
- Finally, a "controlled multi-drilling" module will enable geologists to extract samples, to be stocked in a "shirt" tube.

(Source: *IFREMER, No. 32*, November 1995)

Microsmoke cruise

The IFREMER submersible *Nautile* began a series of 21 dives on 14 November 1995. The goal of this Franco-American cruise was to examine microbiological activity on an active hydrothermal vent (Snake Pit at 23°22 N and 45°57 W), with emphasis on thermophilic and hyperthermophilic populations (living in temperatures up to 110°C), within the framework of the FARA (French-American Ridge Atlantic) programme. These extreme ecosystems provide unique information on the metabolic and taxonomic diversity of these bacteria and archeobacteria, the relation of living organisms to ambient mineralogy and specific cellular characteristics (DNA, use of carbon by heterotrophic micro-organisms). The teams were equipped with complementary sampling tools which will provide material to be examined by seven French and four American laboratories. (Source: *IFREMER*, No. 32, November 1995)

Marine natural products for industrial applications

Extracted from marine molluscs, the vibrantly coloured dye Tyrian purple was behind a flourishing industry for the Phoenicians about 1600 BC. It is an ancient example of applied biotechnology yielding a speciality whose value at certain times was even greater than gold. Interest in this pigment declined in the Middle Ages and, apart from fragrances and vitamins A and D from cod fish oil, it was not replaced by any other economic venture with marine natural products until recently.

Marine natural products occupy a significant position. They have recently contributed to areas as diverse as health-food additives, materials for orthopaedics, thermostable polymerases for the polymerase chain reaction (PCR), and bioadhesive materials, all of which have reached commercial application, while anticancer drugs will hopefully join this group very soon.

Over 200 patent applications on marine natural products have been recorded since 1969. Companies dominate the scene with 64 per cent of the applications, only a few of which are shared with a university. Nearly a third of these industrial applications belong to the Florida-based company Harbour Branch Oceanographic Institution, which specializes in marine natural products but relies in part on academic groups for chemical work. Another similarly specialized emerging company, the Spain-based PharmaMar, has chemical work done for it entirely in foreign academic laboratories.

The remaining patent applications—nearly half of the total—are spread equally over 40 different companies. Some of these grew up quickly just to exploit marine natural products, and disappeared just as fast, probably because of a lack of critical mass.

Major companies, which had no interest in marine natural products in the past, are now filing patents in this area. Since 1989 examples of applications include: from Japan, Hitachi Chemical for adhesive proteins for medical use derived from pearl oysters, Mitsubishi Kasei for bactericidal terpenoids from a sponge, and Mitsubishi Plastics for polysaccharides for healing wounds; Rhône-Poulenc in France for cytostatic agents from ascidians, Hoffmann-La Roche in Switzerland for stabilizing marine oils, SmithKline Beecham in the US for antiviral (HIV) alkaloids from a sponge, and Pharmacia in Italy.

Three US cultural organizations are also active in this field: The Arizona State University, the Universities of Illinois and California. It was at the first two of these universities that the most promising anticancer agents—didemnin B and dolastatin 10—were discovered.

The areas of interest

Human health and health food account for 80 per cent of all patent applications, or 82 per cent if cosmetics are included. A recent addition to this area is a skin-care cosmetic containing the diterpene glycoside pseudopterosin C, isolated from the gorgonian coral *Pseudopterogorgia elisabethae* collected in the Bahamas. This product, which dates back to a patent priority by the University of California in 1987, is now marketed under the name *Resilience* by Estée Lauder in New York.

Drug discovery is dominated by antitumoural and antiviral agents, reflecting the most popular screening systems in use, not only by the two companies specialising in bioactive marine metabolites, Harbour Branch and PharmaMar, but also by the National Cancer Institute and other organizations. This has led to many *in vivo* active antitumoural agents.

Specialities for bone surgery are an area of enormous market potential: the French company INOTEB has used scleractinian skeletons from New Caledonia immersed in a bioabsorbable polymeric matrix, while the US company Norian has imitated the non-protein directed biosynthesis of such skeletons using a synthetic formulation.

Immunoregulatory agents have received less attention because of the current strategy in pharmacology of killing the pathogen rather than strengthening the host. The difficulty of finding efficient immunoregulatory agents cannot be underestimated. Drugs that may cure tropical diseases have also received scant attention, probably because pharmaceutical companies do not see them as cost-effective prospects.

In the food sector, renewable agents have been developed that combine hypocholesterolaemic, anti-oxidative and antiatherosclerotic action. These are needed for growth of larval and juvenile molluscs and crustaceans in aquaculture for human consumption, while some, like docosahexaenoic acid (DHA), are also important for infant brain development after birth.

In contrast, in spite of excellent market prospects, there was almost no practical development of natural antibiofouling agents of marine origin. This probably reflects the difficulty of using field agents, like marine secondary metabolites, that are intrinsically degradable. Synthetic inorganic products are still used for marine biofouling, about which a plethora of patents has been filed recently.

Demosponges have always been the preferred organisms for study by the marine natural product chemist because they are rich in unusual secondary metabolites and are often easy to collect. The high amount of interest in antitumoural and antiviral compounds, which frequently occur in marine demosponges, has ensured that these organisms have become the most familiar in patent applications on marine natural products.

Organisms from the Pacific Basin, mostly collected around Okinawa, account for half of all species in marine natural product applications, while the northwestern Atlantic accounts for about a third of the species—mostly collected in the Bahamas and the Caribbean. The rest come from the Indian Ocean, the Red Sea and the Mediterranean. These data should not to be taken as a direct indication of the most profitable areas for industrially exploitable organisms, however. Organisms from tropical and subtropical waters, in particular coral reef areas, have contributed most, reflecting the greatest molecular diversity from the greatest biodiversity. However, the specific areas have been selected under the bias of logistic and jurisdictional opportunities. The latter are becoming even more of a bottleneck since developing countries are now aware of the value of genetic resources, often asking such a high financial return that companies cannot afford it.

Conclusions and prospects

A look at patent applications on marine natural products reveals that, up to 1993, there has been strong involvement by five companies and three academic institutions from four different countries. Economic success with patents may not come hand-in-hand with quantity, however. A renewable product, whether it is derived from wild organisms, biotechnology or chemical synthesis, is the primary condition for success. Quite a few marine natural products for which patents have been filed in the therapeutic area meet this condition. Compounds from rare animals, and those that are too complex for total synthesis, like the antitumoural macrolides, are excluded from business since the genetic engineering needed to cope with them still lies in the far future, while hopes of obtaining productive invertebrates from aquaculture have yet to be realized.

Prevalent uses of marine natural products

Type	Number of patent applications
Antitumourals/antivirals	
Demosponges	75
Ascidians	14
Molluscs	10
Hemichordates	4
Bryozoans	3
Health food additives	
Protists	39
Bacteria	12
Vertebrates	4
Echinoderms	1
Bone surgery	
Corals	21
Thermostable enzymes	
Archaebacteria	1
Antifungals	
Fungi	1
Various (polysaccharides)	
Protists, bacteria, molluscs	7

Renewable products in the therapeutic area must still go through the lengthy procedures typical for drug approval, and it is therefore not surprising that the only drug of marine origin currently on the market is ara-A, whose study started long ago.

The industrial exploitation of marine natural products has so far only been successful for large-scale products, while the number of easy-to-collect marine macro-organisms that remain to be examined for high added value products is small. In this light it may be surprising to observe an upward trend in the number of patents filed per year. There are two possible explanations for this: the industry was disappointed by computer modelling of drugs, or it has become interested in filing patents about new uses for known marine products. Hopefully the latter task is taken seriously, together with the exploration of the structural variants—metabolites tailored during the evolution of organisms that are in as great a competition as is found in the sea ought to be a gold mine. (Source: *Chemistry & Industry*, 15 January 1996)

Long live reared turbot—the SUTURE project

The turbot, a noble and highly-priced fish, is the subject of a new scientific study concerned with the capacity of certain fish to survive optimally outside their natural habitat before being put on the market. The turbot presents a particularly interesting aptitude for survival when emerged, since cutaneous exchange of gases account for up to 30 per cent of its respiratory needs. IFREMER researchers will thus study the physiological effects of emersion, such as loss of blood oxygen content and pH levels and apparent signs of death, such as cardiac arrests and flat electroencephalograms. Different cohorts will be subjected to varying emersion times and temperatures before being returned to the water. Sensorial analyses will then be carried out to determine if the fish have undergone modifications in terms of their commercial properties.

SUTURE will be carried out as of March 1996 at the Brest IFREMER Centre. (Source: *IFREMER*, January 1996)

How to tell a fish's age

Every year, IFREMER fisheries research teams analyse more than 40,000 samples of the 17 main commercial fish species (anchovies, cod, whiting, hake, saithe, angler, etc.) as well as scallops. The extension of fisheries activities to the deep ocean has generated specific research on two target species, the emperor and the grenadier. Age is usually estimated through the analysis of otoliths, small calcium carbonate growths in the inner ear which present daily and seasonal marks of both internal and physical fluctuations, thus enabling the identification of life cycles as well as ephemeral phenomena such as pollution and climatic anomalies. The recent discovery of daily marks, observed with a high-powered electron or photon microscope, greatly increases research possibilities, notably in tropical species which are not subjected to seasonal changes. Methodologically, the study is also establishing international standards for analyses and new software for the estimation of age as well as new techniques for decoding chemical data. IFREMER has united its efforts for this project with ORSTOM, working out of the LASAA laboratory in Brest. (Source: *IFREMER, No. 33*, January 1996)

Prototype vehicle for seabed exploration

Mitsui Engineering & Shipbuilding Co. Ltd. (MES) and the University of Tokyo have jointly completed the first prototype of an autonomous underwater vehicle (AUV) called R-One Robot which is designed for exploring wide areas of the seabed as an untethered and self-propelled machine.

Use of a diesel-electric drive for the propulsion is said to be the most outstanding feature of the robot. The R-One Robot was tested at the Ship Research Institute of the Ministry of Transport and achieved a favourable performance.

Measurements in the sea at present are carried out generally by lowering measuring devices or tethered vehicles into the sea from "mother" ships. However, comprehensive exploration of the vast ocean beds and mid-ocean ridges where the ocean "plate" is formed is almost impossible by traditional methods.

Tethered-type underwater vehicles are limited to a narrow survey area, and manned vehicles require special safety measures for the crew. Development, therefore, of the AUV with automatic measurement systems will solve these problems. The AUV can also survey dangerous areas such as the location of an active volcano.

The R-One Robot requires no remote control from the "mother" ship during underwater navigation. The autonomous operation system allows the robot to dive and navigate to conduct measurements of the deep sea environment and seabed for 24 hours on a continuous basis.

The newly-developed closed cycle diesel-electric power plant enables the robot to operate for a long time. The plant is compact and inexpensive, but has a large output to supply high-density electricity for the main propulsion system, two thrusters, control units, navigation equipment and measurement devices. The robot also has an inertial navigation system to automatically measure its movements.

The R-One Robot is the first closed cycle diesel-electric drive type among various AUVs developed worldwide, measuring 8.3 m long and 1.5 m hull diameter. The maximum diving depth is about 400 m.

A wide payload space is provided in the robot for installation of various scientific measurement devices. The following measuring equipment can be carried: oxygen; carbon dioxide (CO_2); and metallic concentration detectors; magnetic and gravitational field markers; and still and TV cameras.

The closed cycle diesel-engine system developed for the R-One robot uses a diesel engine currently available in the market for reduced manufacturing costs, which is a great advantage for such an AUV. The system consists of a diesel engine, generators, CO_2, absorber, LOx tank, fuel tanker, oxygen concentration measurement device and controller. These are all installed in a compact pressure vessel, and start-up and stopping of the system is automatically achieved by external signals.

Exhaust gas from the diesel engine is treated by passing through exhaust gas and processing units in which exhaust gas is cooled and combustion products such as carbon dioxide and vaporized water are removed. Oxygen is then added to maintain the partial pressure of oxygen at approximately 0.27 atmospheric pressure for recycling use.

There is no need to discharge waste gas outside the vessel, thereby enabling extended operation in deep seas. Sea tests of the robot in shallow waters and sea environment measurements in the ocean are now being carried out. (Source: *The Dock & Harbour Authority*, February/March 1996)

Breakthrough technology. Seismic exploration solution

Chevron Petroleum Technology Co. (Houston, Texas) developed a software program capable of compressing 3-D marine seismic datasets to less than 1 per cent of their original size. This new technology will revolutionize and dramatically speed up the evaluation of seismic data, according to the company.

Satellite transmission of compressed data from a seismic survey vessel to an onshore processing centre now can be completed the same day it is acquired while retaining the integrity and quality of the data. Importantly, the data retains the detailed, high-resolution necessary for effective interpretation, giving improved fiscal and intellectual management of reservoir analysis.

Considering that industry conducts 200 to 300 seismic surveys each year, the technology offers extraordinary opportunities for cost savings and improved time efficiency. (Source: *Sea Technology*, March 1996)

Trimble upgrades HYDRO™ software system

Trimble Navigation New Zealand Ltd. (Christchurch) has released an upgrade to its HYDRO™ software system. New features include increased database size, more powerful processing in data handling for contouring and volume calculations, and a Windows® "look and feel", according to Gary Chisholm.

Trimble's HYDRO processing software includes several standard navigation/data acquisition and editing modules to examine and edit field data; to input tides for sounding reduction; to filter, adjust, and pass field survey data to the database; and to use as file interface. In addition, there are optional processing modules designed for specialized data processing, reporting and plotting. (Source: *Sea Technology*, March 1996)

"Sea Anchor" theory expands understanding of earthquakes

Scientists have discovered why the world's largest earthquakes occur in some places where the Earth's crustal plates collide but not in others. The question has puzzled Earth scientists for 25 years. The answer is a great "sea anchor force" at work in the thickly fluid mantle below regions where the plates converge, scientists at Columbia University's Lamont-Doherty Earth Observatory and the University of Chile reported in the November issue of the *Journal of Geophysical Research.*

They found that when an oceanic plate meets another plate and bends down into the relatively soft mantle below, it does so at a shallow angle if the two plates are moving towards each other but at a steep angle if they are moving in the same direction over the underlying mantle. The sea anchor force, long used by mariners to aim their ships in stormy seas, determines the angle of descent or "subduction" into the mantle, they found. Shallow dips intensify earthquake-causing friction at the critical zones where plates rub together. Deep dips relieve the friction so that earthquakes do not occur.

A sea anchor is a drogue—or canvas bag—that has great resistance to being pulled through water. In a storm, sailors throw one over the bow on the end of a cable. When the wind blows against the ship, the sea anchor is forced upward through the water to a shallow angle as it retards backward movement. When the wind blows with the ship, the sea anchor is forced downward through the water until it hangs straight down.

The descending plate moves through the viscous mantle like a sea anchor through water, the two scientists reported. When the upper plate is moving over the mantle into a shallow angle of descent—like the sea anchor of a ship against the wind. When the two plates are moving in the same direction over the mantle, the sea anchor force pushes against the slab and bends it down steeply—like the anchor of a ship going with the wind. (Source: *Sea Technology*, March 1996)

New images reveal diverse seascapes off US coast

Scientists at Columbia University's Lamont-Doherty Earth Observatory unveiled images from the most extensive, highly detailed mapping ever done of the sea floor off the US coast.

The new images reveal the surprisingly different appearances of the sea floor off Oregon, California, Louisiana, Florida, New Jersey and Maryland, and they allowed the first detailed comparison of different parts of the US continental slope.

The images show that the sea floor off the US coast is as remarkable and in some ways as alien as landscapes seen on Mars or Venus.

The scientists analysed an unprecedented collection of ocean-bottom depths measured by ships that record sound echoes from the sea floor. The data provide much more direct, detailed, and accurate information on what the ocean floor looks like than sea floor maps based on satellite measurements—such as the one recently revealed by the National Oceanic & Atmospheric Administration (NOAA). Satellites can only resolve features larger than 5 square miles. Sophisticated instruments aboard modern research ships can resolve features 5,000 times smaller, though it would take many hundreds of years by ship to map all the world's oceans.

The detailed bathymetric data were gathered in the 1980s and 1900s by NOAA and during cruises funded by the National Science Foundation. (Source: *Sea Technology*, March 1996)

Kaiko-Tokai cruise

The Kaiko-Tokai area, explored by a French-Japanese team aboard the RV *L'ATALANTE*, from 14 March to 12 April 1996, is part of the Nankai seismic subduction zone. It is here that the sea plate of the Philippines burrows under the south-east tip of Japan at a rate of 4 cm per year, triggering earthquakes every 150 years. The last recorded earthquake of consequence occurred in 1854, thus causing apprehension among seismologists who fear a quake with a magnitude above eight on the Richter Scale. The observers attempted to find traces of ruptures caused by the two previous quakes, using the IFREMER SAR, a high-resolution lateral sonar and a map of the site was drawn up using *L'ATALANTE's* multibeam echo sounder. The cruise also examined large-scale fluid circulation, especially in major faults which act as preferential drains. These were measured and quantified with a VESP (VEnt SPider) device from the University of Kiel in Germany. (Source: *IFREMER No. 34*, March 1996)

Red algae: recognizing the right stuff

Several species of *Graciliaras* (red algae) are industrially processed to obtain agar, a widely-used substance in the food industry. There are three types of red algae and only the *Gracilaria verrucosa* species is authorized by the public health authorities as fit for human consumption. The plant, considered a "sea vegetable", yields a high rate of proteins, used as food additives and classified as E 406. To distinguish the authorized plant from the other red algae, engineers have developed an anti-fraud identification method based on the use of electro-phoresis, enabling protein extraction with a technique using a combination of demineralized water and ultra-sound. (Source: *IFREMER* No. 34, March 1996)

The recent evolution of European and Mediterranean aquaculture

The latest statistical data on aquaculture in the Euro-Mediterranean zone brings to light two major tendencies: scarce sites and environmental constraints have lowered growth rates, but operating companies are now reaching the stage of industrial production. Despite a yearly growth rate of 3 per cent between 1988 and 1993, Europe's share of world production fell from 9 per cent to only 7 per cent, mainly due to the phenomenal growth in aquaculture in Asia, with growth rates of 10 per cent per year, according to the FAO. Europeans are almost completely absent from the crustacean and algae sectors, concentrating on shellfish and fish. For the latter, European growth has kept pace with world rates, mainly due to the development of intensive salmon-rearing in the Atlantic and sea bass and bream in the Mediterranean. Growth rates vary according to country, with Norway, the UK and Ireland leading the way. Industrialization in the sector is mainly concentrated in the salmon sector and almost exclusively in sea water. In France, the Salmona-Aqualande group is attempting to diversify into other species, including freshwater fish. (Source: *IFREMER* No. 34, March 1996)

Vertical cable seismic launched

In the rapidly occurring geophysical revolution that is transforming the petroleum exploration industry these days, numerous new techniques are being introduced that purport to lower the cost of acquisition, making it easier, faster, more accurate, or a combination of all of these. One such innovation that actually appears to achieve all these goals is the new vertical cable seismic acquisition technology developed by geophysicists at Texaco's exploration and production technology division in Houston, Texas.

The difference between conventional seismic surveys and those employing the new vertical cable technique is, as its name implies, in the way in which the hydrophones are deployed. Conventional surveys have the hydrophones attached to long streamers that are pulled through the water horizontally behind the seismic vessel, which also pulls the energy sources, usually high-pressure air guns.

A vertical cable survey, on the other hand, has its hydrophones attached to cables that are suspended vertically between strong buoys on the sea surface and heavy anchors on the sea floor in specific acquisition designs around the target subsurface structure, regardless of the degree of seabed irregularity. The source boat fires its high pressure air guns above and around the cables in an even larger pattern.

When shot, the vertical cables are then redeployed to another location and another swath of data is acquired.

Texaco has developed a proprietary data-processing program specifically for use with data acquired with the new vertical cable method, that economically and efficiently produces the 3-D information with higher resolution than that acquired through conventional 3-D methods. Furthermore, the data is actually acquired in a 3-D sense rather than the conventional series of 2-D lines. Thus, more complete information is produced and more accurate analysis is possible.

Vertical cable seismic is a significant step forward in our ability to more accurately image the subsurface. The integration of data acquisition and data processing provides true three-dimensional information faster and cheaper than before. In so doing, it expands opportunities for evaluation of exploration and producing properties. (Source: *OFFSHORE*, March 1996)

Real-time seismic evaluation

A Chevron subsidiary, Chevron Petroleum Technology Company (CPTC), has launched a software system for seismic data compression that its developers believe will revolùtionize seismic acquisition and facilitate getting new oil and gas fields onstream sooner. The system, an algorithm to be applied primarily to 3-D datasets, is to be employed on board seismic vessels during a shoot and as the data is being acquired in order to compress the data for transmission by satellite to an onshore processing centre. This system aims to facilitate rapid processing and interpretation in real-time while the vessel is still on prospect in the event questionable or interesting areas need reshooting.

Developed by the University of California at Los Angeles and a Chevron team, the new technique makes timely evaluation and decision-making possible and is expected to significantly reduce the cycle-time in the exploration phase of a field.

The software program is capable of compressing 3-D marine seismic datasets to less than 1 per cent of their original size, permitting their transmission by satellite without disturbing the integrity or quality of the data.

Chevron successfully tested the new seismic data compression technology during the summer of 1995 on its Ninian Field in the UK sector of the North Sea. Ninian was chosen because a multi-streamer, 3-D survey was already planned to further delineate the field's reservoir. Compagnie Générale de Geophysique (CGG) was chosen to carry out the seismic acquisition, using the *M/V Mistral* seismic vessel, which had been outfitted with the CPTC-developed seismic data compression software kit that runs on most standard computer architectures.

During the field test, the data was pre-processed by the contractor on board as it was acquired, then the preprocessed dataset was read into the Chevron workstation and compressed from 4.5 gigabytes (raw data of 18 gigabytes per boat preprocessed to 4.5 gigabytes) to 80 megabytes. Thereupon, it was transmitted via satellite link to Brechin, Scotland for relay on to Chevron's London processing centre, where it was decompressed and processed in parallel with the original data recorded on shipboard tape. The original data required nearly five hundred 3480 tapes, whereas the compressed data, reduced by a ratio of 60 to 1, filled just one high-capacity tape.

The tremendous surge in the use of 3-D seismic data has brought with it escalating costs and lengthened turnaround time between acquisition and processing—sometimes as much as a year—creating tremendous difficulty in managing large datasets. Usually, upon acquisition, seismic data is recorded on magnetic tape and the tapes—in considerable volume—are then transported to a processing centre when the vessel completes the shoot and returns to port, frequently six or more weeks after the first data was acquired. Until now, no better than 20 to 1 compression ratios have been achieved, but Chevron's seismic data technology is able to reduce a terabyte-sized (trillion bytes) dataset to a manageable 10 gigabytes or 10 billion bytes. And, in its trials during the summer of 1995, averaged a 30-hour turnaround time from data acquisition to decompression. (Source: *Offshore*, March 1996)

High-performance digital ocean bottom seismometer for shallow waters

The Central Research Institute of the Electric Power Industry (CRIEPI) has developed a digital ocean bottom seismometer enabling feeble earthquakes to be detected very accurately even in shallow waters and coastal areas, which had been difficult up till now due to the strong influences of sea waves and land-based noises.

This research project was implemented to resolve the problems encountered in conducting surveys of seabed geological structures in sea regions shallower than 50 m along the coastal regions of the Japanese archipelago due to the technical difficulty of performing geophysical explorations and data analysis in shallow sea regions.

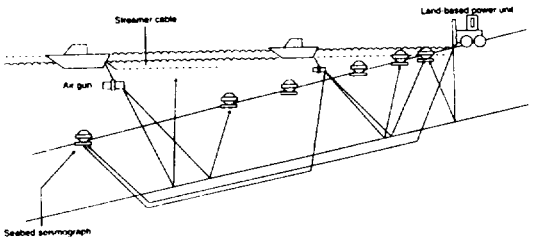
The new digital seismometer has an overall size of 55 cm in both length and width, and consists of the sensor unit, preamp unit, recorder unit, acoustic transponder, flasher unit, power unit and an electronic control unit consisting of other electronic circuits, all of which are accommodated in a glass sphere capable of withstanding a pressure of 600 Pa. The base part serves as an anchor, a cutoff system is provided to free the seismometer from the anchor whenever necessary, and the entire system weighs about 30 kg.

This seismometer detects tremors with a sensor, amplifies the signals with an amplifier and records these amplified signals. The amplifier incorporates a filter

function for removing undesirable noises, so even feeble tremors can be detected in shallow waters where diverse extraneous noises are present.

The seismometer is installed in the seabed by dropping from a ship and, after observations, the anchor is dropped to allow the device to float naturally for recovery with instructions from the ship. A mechanism is introduced that retains the sensor on a horizontal plane even on an inclined seabed, so stable observations are possible even on a seabed with a maximum inclination of 25°.

Conceptual diagram of survey in shallow waters using seabed seismographs



The research team conducted experiments by selecting a sea region with desirable environmental conditions, a depth of about 30 m and good transparency, to permit confirmation of the installation of the digital seismometer. Vibrations were generated by using vibration generators such as air guns, the reflected waves were detected with the seismometer, and highly satisfactory performance was confirmed through computerized processing.

Whereas the conventional system uses several spherical microphones connected together with a long cable for making measurements in shallow waters, a unique characteristic of this new seismometer is that there is no need for any cable, so the characteristic is a so-called seismic measurement robot.

At present, several of these digital seismometers are being installed linearly to survey the profile of the geological structure. CRIEPI will study the geophysical exploration method by installing these seismometers in two directions in order to understand the three-dimensional geological structure.

More information is available from the Central Research Institute of the Electric Power Industry, Public Communications Div., 1-6-1, Ohtemachi, Chiyoda-ku, Tokyo 100 (Tel.: +81-3-3201-6601; Fax: +81-3-3287-2863). (Source: *JETRO*, April 1996)

The worm, the oyster and the researcher

Researchers at the IFREMER station in Port-en-Bessin have been studying a curious worm, the *Lanice conchilega*, which has been colonizing oyster-farm beds since 1986 in the prime oyster-farming area of Grandcamp-Maisy, in the Bay of Veys, located in the Calvados Département of Normandy. The worm comes into competition for food with oysters and contributes to increased sedimentation already engendered by farming devices such as metallic tables. IFREMER researchers have drawn up maps of the population density of these areas, showing significant progression in the last three years. At the same time, studies launched in 1994 have yielded important findings on the worm's growth patterns, showing that the population increase is largely due to the migration of adults from other areas in the Bay of the Seine. Researchers are continuing their work to determine how the invasion could be counteracted. (Source: *IFREMER No. 35*, May 1996)

Prevention measures for materials at sea

Little is yet known about the deposits of what engineers refer to as "biological film" (often forming only a few hours after submersion), a major problem being explored in a programme coordinated by IFREMER. Materials in the sea suffer from these biological deposits which increase weight, slow down thermal exchange and cause mechanical breakdowns and other forms of deterioration. The goal of the study is to determine the stages from primary deposits to animal habitation via bacterial and plant adherence. Several processes have been tested, such as biocidal and anti-clinging substances as well as thermal or electrical shock processes. Research teams include participants from the Brest Faculty of Sciences, Rennes University, Elf Aquitaine Production, the Paris Higher Chemical School, the Engineering and Hygiene Laboratory of the INRA and the Molecular Genetics Laboratory of CNRS Lyons. (Source: *IFREMER, No. 35*, May 1996)

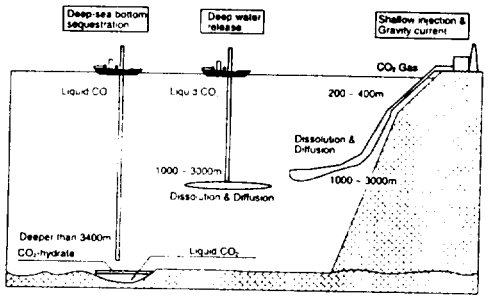
Gas lift advanced dissolution system for CO_2 sequestration into deep ocean

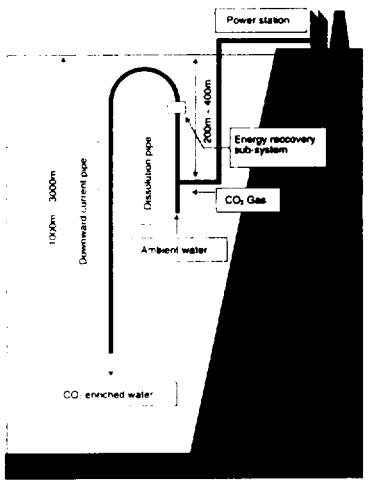
The National Institute for Resources and Environment of the Agency of Industrial Science and Technology, Japan, has devised a new technique for the sequestration of carbon dioxide (CO_2) gas, the cause of global warming, into the ocean at a high efficiency and low cost, and corroborated the effectiveness with a small laboratory-scale experimental system.

The Gas Lift Advanced Dissolution (GLAD) System is proposed for CO_2 sequestration into the deep ocean. The sequestration into the deep ocean. The system consists of a pipe of inverse J-shape settled in shallow waters 200-400 m deep. CO_2 gas emitted from power stations, for example, is transported with an undersea pipeline and injected into the GLAD system. The CO_2 bubbles form a buoyant plume in the system, but are dissolved into the sea water while rising. The dense solution is released from the other side of the pipe. In the injection side of the pipe, an upward current is generated by the gas lift effect. On the other side of the pipe, a downward current is generated by the density difference. The sea water inside the pipe is made to flow by action of the rising force of the gas bubbles, so there is no need for a drive unit for moving the sea water.

Several concepts have been proposed for CO_2 sequestration in the ocean, such as storage on a seabed deeper than 3,400 m, the release of liquid CO_2 into sea water deeper than 1,000 m and the injection of CO_2 gas into a shallow sea region.

Several concepts of CO_2 sequestration into the ocean





Basic concept of GLAD system

The significant advantages of the GLAD system are that water circulation provides the necessary pumping effect, the fresh sea water provided at the CO_2 injection point helps rapid CO_2 dissolution, and the pumping effect accelerates the downward current of CO_2-enriched sea water. In addition, the pipe prevents horizontal diffusion before complete dissolution, while the dissolution and transportation of CO_2 in the pipeline of inverse J shape reduces adverse environmental impacts in shallow sea regions. This is a great advantage compared with the usual ideas of injecting CO_2 in shallow waters. (Source: *JETRO*, June 1996)

Technology for recovering useful rare metals from the sea water

The Takasaki Radiation Chemistry Research Establishment of the Japan Atomic Energy Research Institute has corroborated the effectiveness of technology established to recover useful rare metals from sea water through preliminary tests. The adsorption bed employed for the recovery of rare metal is repeatedly usable for about 10 times.

The recovery system is based on a contact adsorption bed bearing amidoxime adsorbents. The amidoxime adsorbents of a porous hollow fibre form are prepared by radiation-induced graft polymerization of acrylonitrile onto porous polyethylene-based hollow fibres with subsequent amidoximation. The prepared amidoxime hollow fibres are used as the packing materials in the adsorption bed for recovery of uranium and other useful metals from sea water. The sea water flows under pressure through the adsorption bed. Metals collected by the amidoxime hollow fibres can be separated and purified by different concentrations of hydrochloric acid.

Presently, preliminary experiments on the sea are being advanced. A miniature version of the commercial version of the adsorption bed, with a diameter of 4 m and a thickness of 15 cm will be built in the future. This recovery system will be used to recover rare metals from sea water for subsequent experiments.

For more information, contact Japan Atomic Energy Research Institute, Takasaki Radiation Chemistry Research Establishment, 1233, Watanukimachi, Takasaki City, Gunma Pref. 370-12 (Fax: +81-273-47-2561). (Source: *JETRO*, June 1996)

Results from Caribbean expedition

Crater fragments found more than 1,000 km away from the impact site, unexpected ancient volcanoes, evidence of long-ago global warming, and clues to a recent climate change are just a few of the results of a recent National Science Foundation Ocean Drilling Programme research expedition.

Departing from Miami, Florida, a few days before Christmas 1995, the drillship *JOIDES Resolution* set out for the Caribbean Sea on a two-month expedition of one of the greatest catastrophes in Earth's history: the meteorite impact that caused the extinction of the dinosaurs and other life forms some 65 million years ago. Recent studies show that the meteorite impact occurred on the north end of the Yucatan Peninsula in Mexico, creating the 180-kilometer-wide Chicxulub crater, which is currently buried under younger sedimentary rocks.

By drilling deep into the ocean floor in the Caribbean Sea, scientists on this expedition extracted valuable materials blasted out of the Chicxulub crater at the time of the great impact.

During the expedition, scientists discovered evidence that volcanic eruptions in Central America have repeatedly spread layers of thick volcanic ash over the Caribbean in the past.

Scientists also expect the recovered sediments to produce a record of how tropical climate has varied on time scales of tens of thousands of years over the recent geologic past. (Source: *Sea Technology*, June 1996)

Instrument allows measurement of underwater fluorescence

Under ultraviolet light, many otherwise drab corals, anemones, shrimps, and other organisms mysteriously fluoresce in brilliant colours. Such displays are, in many circumstances, still a mystery, with little known about what causes the illumination within tissues or the function of such brilliance.

To study this phenomenon, researchers at Massachusetts Institute of Technology's Department of Ocean Engineering, designed and built a prototype instrument to measure the spectral distributions of underwater fluorescence. They did so in collaboration with graduates at the Department of Mechanical Engineering.

The device that they built uses a light source, filters and fibre optics to excite the fluorescence of corals and other organisms. A low-cost spectrometer, which measures incoming light, is hooked up to a computer that logs and stores the spectral data. While some instruments measure a limited range of wave-lengths, this device—which they call

a benthic spectrofluorometer—measures the entire spectrum of light emitted. Housed in two watertight plastic boxes, the contraption is small enough to be strapped to a diver's wrist or chest.

The device is of use to researchers who study how light interacts both with the sea floor and the organisms that live there.

This MIT Sea Grant-funded research has led to four related research projects. In a project funded by the Office of Naval Research's (ONR) Environmental Optics Programme, ocean engineering graduate student Eran Fux travelled to Florida's Dry Tortugas with the fluorometer to study both fluorescent and reflected light of corals as part of a multidisciplinary team. The ONR's Environmental Optics Programme has also provided funds to study fluorescence in the Caribbean through photography, video and spectral measurement. That work will be coordinated with efforts to better understand why coral fluoresces and why it does so with varied spectral characteristics, intensity and distribution. (Source: *Sea Technology*, June 1996)

Marine structure completed for fish cultivation and efficient use of marine space

The marine structure under joint development by the Japan Marine Science and Technology Centre and Iwate Prefecture has been completed in Funakoshi Bay, Ohtsuchi Town, Iwate Prefectural Government. This structure was fabricated as a part of the "Offshore Marine Space Utilization Expansion Technology Development Project" carried out over a period of three years during 1994-1996.

The middle-layer floating-type offshore artificial seabed can be installed offshore up to a depth of 100 m and can be submerged and floated flexibly. The structure will be used in research to develop technologies for cultivating fish and shellfish in offshore waters as well as for developing technologies to expand the use of offshore marine space.

The offshore artificial seabed was designed with a strength which enables installation in offshore regions with a depth of up to 100 m. The facility demonstration tests will be conducted in Funakoshi Bay in an area with a depth of 40 m.

The facility is a steel welded structure consisting of the artificial seabed structure (36.4 x 20 m) and a machinery chamber tower at its central part, and is fixed in position with two mooring lines. The artificial seabed structure is equipped with a main sea water tank in the centre and four corner tanks. Stability is maintained by suspending balancing weights from the facility. The artificial seabed structure is a frame structure for installing about 340 cages measuring 1 m on all sides. Passages are provided at various parts to expedite associated tasks.

To enable the artificial seabed structure to utilize the ecological depth zone of natural marine organisms effectively, it is normally submerged to a depth of 7 m, and only the machinery room protrudes from the sea surface, so rolling and pitching due to waves are minimized. When floating, a generator in the machinery room pumps out about 33 tons of sea water from the main sea water tank in about 60 min. When submerged, the valves in the machinery room are opened and the main sea water tank fills with sea water to submerge in about 25 min. The facility can be loaded with roughly 30 tons of cargo on land, and when loaded, the sea water is pumped out of the corner tanks to adjust the draught and tilt.

The structure moves about slowly without problems with the waves in rough seas, and maintains a stable state in calm waves. It is designed to withstand significant waves of 10 m, frequency of 13 sec and wind velocity of 40 m/sec. The main parts are maintenance-free for a period of five years, but deterioration over time will be assessed by divers and unmanned survey equipment to monitor the structure condition through non-destructive underwater surveys.

For information, contact Japan Marine Science and Technology Center, 2-15, Natsushima-cho, Yokosuka City, Kanagawa Pref. 237, (Tel.: +81-468-66-3811; Fax: +81-468-66-2119). (Source: *JETRO*, June 1996)

Researchers avoid catching small fish by expanding net meshes

To avoid catching undersized pollock, fishermen in the Bering Sea are increasing the size of the openings—or meshes—in pollock nets.

Previous Washington Sea Grant programme studies have proven that the use of large meshes could reduce the catch of unwanted or unusable fish in the West Coast black cod and sole fisheries. However, researchers did not know if these techniques could be used in the Bering Sea pollock fishery, where nets and catches are among the largest in the world.

At the request of pollock fishers, Washington Sea Grant researchers tested experimental big-mesh pollock trawls during a recent study managed by the Alaska Fisheries Development Foundation in collaboration with the University of Alaska Fisheries Industrial Technology Center, funded by the Saltonstall-Kennedy Programme. Partly as a result of this research, the North Pacific Fishery Management Council adopted regulations that would increase the size of meshes in pollock trawls.

The pollock studies focused on mesh in the codend, the collection bag at the back of the trawl. (Source: *Sea Technology*, June 1996)

Research provides weapon against shellfish disease

Modified viral particles (called retroviral vectors) have been used for the first time to alter the genes of a marine invertebrate. This research may provide a new tool for marine biologists to use against the diseases that attack commercial stocks of oysters, clams, mussels and abalone, according to researchers at the University of California at San Diego's Department of Pediatrics and School of Medicine.

Once the genes responsible for protecting cultured shellfish from disease have been identified, retroviral vectors could be used to deliver these protective genes directly to brood stock. (Source: *Sea Technology*, June 1996)

Cloning may lead to year-round soft-shelled-crab supply

In a recent project expected to revolutionize the soft-shelled crab industry, Sea Grant researchers have successfully cloned genetic material that allows blue crabs to regulate moulting and establish their protective shell. Understanding the chemical mechanisms that control this process is a key discovery in an effort to manipulate crab development to produce a dependable supply of soft-shelled crabs (which are actually crabs that recently shed their protective cover).

The cloning experiment—led by Mississippi/ Alabama Sea Grant researcher Doug Watson—focused on a gene that codes for a protein known as moult-inhibiting hormone (MIH).

At normal concentrations, MIH blocks shell shedding and maintains the crab's protective cover. However, as a crab develops, it continually outgrows its shell and must replace it with a new, larger one. At that time, concentrations of MIH fall and the crab enters moulting.

Under natural circumstances, this process occurs irregularly, limiting the industry's ability to take full advantage of potential soft-shelled harvests. However, now that MIH genetic material has been cloned and the MIH hormone can be produced in large quantities, researchers can experiment with substances that could block the hormone's activity and force the crab into moulting. This ability could produce an abundant, year-round, and controllable supply of soft-shelled crabs for the Gulf of Mexico soft-crab industry and consumers of seafood. (Source: *Sea Technology*, June 1996)

Protector from the deep—a sun cream derived from coral

Secrets from the sea may protect us from the sun. Chemicals extracted from corals and sponges have been used by scientists at the Australian Institute of Marine Science, North Queensland to create the world's first marine sunscreen.

The super sunscreen, with a protection factor of 50-plus, is based on the ability that marine flora and fauna have evolved over millennia to protect themselves from the sun, and its harshest ultraviolet (UVB) rays in particular. Hard reef-building corals, for example, which are exposed to intense tropical sunlight in shallow water during low tides, can resist the ravages of radiation for hours at a time.

Their resistance intrigued researchers. In the laboratory, living tissues of corals were scrutinized and found to contain a class of special amino acids, called mycosporins. These are produced by symbiotic algae that synthesize some of the food consumed by coral polyps. The most remarkable characteristic of mycosporins is their ability to absorb ultraviolet rays. Mycosporins—organic compounds also found in fungal spores—are not new.

The scientists then discovered that mycosporins were stable only as long as they remained in coral polyps; when isolated from their hosts, they became very sensitive to heat, light and variations in acidity or alkalinity.

After analysing the molecular structure of mycosporins, researchers synthesized chemical analogues. About 700 synthetic molecules were produced over five years before one compound with the desired characteristics was eventually selected.

Its molecular arrangement is nothing like that of mycosporins, but it boasts ideal properties, such as being odourless, colourless, non-staining and water-resistant. The compound is also three times better at blocking UVB rays than existing preparations. Producing it should be easy and cheap. Armed with the chemical key to the sun-blocking properties of mycosporins, scientists did not have to use precious corals to make sunscreens; they could be readily produced using commercially available chemicals which are relatively cheap.

In animal trials over two years, the new sunscreen was applied to the skins of a strain of hairless mice, which are used in cosmetic experiments. The mice withstood high levels of exposure to ultraviolet radiation without experiencing any side-effects, such as skin irritations, discolouration or allergic reactions.

The polymers used in paints, varnishes and plastics may also benefit from the discoveries. Paints, for instance, tend to break down as a result of heat and ultraviolet radiation. The result would be a paint or plastic that lasts longer—and that does not get a tan. (Source: *Guardian OnLine Technology*, 14 March 1996.

The sea urchin: the sea's pollution watchdog

Since 1991, IFREMER has been closely examining the sea urchin as a biological indicator of chemical pollution, in cooperation with the University of Western Brittany, as part of the Brest Urban Community's project for its offshore waters. The goal is to analyse the state of health of urchins as an indicator of potential contamination. The shellfish are scrutinized both in their environment and in laboratory conditions in terms of morphology, demographic patterns, ecotoxicology and other anomalies and are compared to similar animals offshore of Concarneau (South Finistère), chosen for the quality of its water. The sea urchin has proven to be a good indicator of pollution hazards since the populations off the coast of Brest suffer more than those further out to sea and in Concarneau. (Source: *IFREMER, No. 36*, July 1996)

The valvometre out in the field

During the second half of 1995, IFREMER researchers for the first time obtained a large series of data recorded by a valvometre, specially-designed equipment capable of assessing pollution levels in the environment through the measurement of the gap between the two shells of oysters or mussels. The programme, begun in an oyster farm in the North Finistère in 1995, revealed the appearance of a toxic plankton, *Gymnodinium*, thus generating hopes of setting up early warning signals for this affliction which renders shellfish unfit for human consumption. In July 1996, the programme was renewed for the year and researchers are now gathering physical and biological "signals" sent up by shellfish. (Source: *IFREMER, No. 36*, July 1996)

E. ENVIRONMENT

Oil spills and their clean-up

Major oil spills often grab the headlines around the world. Such incidents have created a global awareness of the damage oil can cause to the environment. The risk of oil spillage will not diminish in the near future, although preventative measures have and will continue to reduce the frequency and number of such spills. Continued improvements in clean-up techniques and response capabilities will also reduce the damage caused by spills.

Although prevention is the logical means of reducing oil spills, some accidents will still occur. Being prepared for such an eventuality is an important concern for both industry and government authorities. Fast and effective response is a means of avoiding further environmental damage.

No two oil spills are exactly alike. The behaviour of oil on water or land and how well the spill can be contained are highly dependent on the oil type, the location and volume of the spill, weather conditions and a host of other factors. The most effective clean-up and containment methods vary from spill to spill and often from site to site in a specific incident. The efficiency of clean-up equipment and techniques may also change with time, as weather conditions fluctuate and the character of the spilt oil is altered. Consequently, a wide range of clean-up techniques and equipment need to be considered.

The priority in any spill is to stop the source of the oil leak. The second step is to contain the spill so that further environmental damage does not occur. Once the petroleum product or oil is contained, the next job is to remove or treat it quickly. Often the spilt oil will reach the shoreline, in which case it will be removed if it looks like it could cause further water recontamination or damage to the shoreline ecosystem.

Containing an oil spill involves the use of booms to confine the oil to a specific area. The primary objective is to concentrate the oil in thick layers so that it can be recovered. Alternatively, diversion, a related technology also using booms, attempts to stop the oil from entering a given area.

Once an oil spill has been contained, the next step is to recover the oil from the water surface. In most cases, containment and recovery proceed simultaneously. The most common units for removing oil are called skimmers.

Each type of skimmer has its advantages and disadvantages. The effectiveness of any skimmer depends on a number of factors including the type of oil spilt, the thickness of the slick, the presence of debris in the oil or on the water, the location of the spill, and the ambient weather and sea conditions. Most skimmers recover oil satisfactorily when the oil layer is thick. As a result, containment is important, and skimmers are best used in conjunction with special containment techniques. Sea conditions have the largest influence on the effectiveness of skimmers. When high seas prevail, many skimmers, especially weir and suction skimmers, take up more water than oil. Recovering oil on the high seas remains one of the problems still to be solved in oil-spill clean-up.

The post-recovery treatment and disposal of recovered oil is in itself a very large problem. Sometimes recovered oil can be recycled by sending it to a refinery for re-use. In order to do this, the oil must be de-watered and free of debris. Highly viscous and debris-laden oils cannot be recycled effectively and are usually disposed of by incineration or by placing in a landfill.

Shoreline clean-up is the one area in which significant advances have been made in recent years. It is an area that is complex because the conditions vary considerably. Flat, sandy beaches are the exception rather than the rule. Rocky shorelines are more common in the northern hemisphere than sandy beaches. When oil arrives at the shore, it can be deposited in crevices or in the spaces between rocks. If the oil adheres to rocks, it is difficult to remove. The longer oil remains on the beach, the more difficult it is to clean up.

The most common method of shoreline clean-up is still physical removal. Care is taken to avoid causing severe physical or biological damage when using these techniques. The use of mechanical equipment such as graders (construction equipment) is generally restricted to sandy beaches where the emphasis is on restoring the beach to the public as quickly as possible.

The most common cleaning technique for gravel or rock shorelines is to use low-pressure cold-water flushing. This is effective when the oil is relatively fresh (otherwise the oil may adhere tightly to the rocks). Hot-water, steam and high-pressure sprays, although useful for man-made shorelines such as piers and jetties, can harm the animal and plant life on the shoreline. It is better to remove the bulk of the oil quickly using cold-water flushing than to clean it thoroughly using a more invasive technique and cause damage to the shoreline and its inhabitants.

Dispersants are chemical agents which cause the oil to form small droplets which can then move into the water column, where natural processes can act on the oil. They are typically applied from low-flying aircraft and sometimes from boats and ships.

The effectiveness of dispersants depends mainly on the oil type and then on sea energy. Heavy oils and highly weathered oils may not disperse at all under certain conditions. Light oils will disperse well, but may also disperse naturally. Laboratory effectiveness and field test effectiveness values are typically about 50 per cent for a light crude and 20 per cent for a medium crude with little or no effectiveness for residual fuels. The use of dispersants is a trade-off between a number of factors, including shoreline protection, protection of birds, and the realization that only part of the oil would be removed in any case.

The major problem with most treating agents is effectiveness. This is generally a function of oil type and composition. Crude and refined oil products have a wide range of molecular sizes and composition, leaving little scope for a universally-applicable and effective spill control chemical. The other major elements in agent effectiveness are environmental parameters such as temperature and sea energy. These can be highly dominating and will occasionally overwhelm most of the other factors. Toxicity testing is also important—many products tested by environmental agencies have high and unacceptable aquatic toxicities.

Solidifiers or gelling agents

Solidifiers change the oil from a liquid to a solid. These products often consist of polymerization catalysts and cross-linking agents. Effectiveness testing on several solidifiers indicates that many of them require 15-20 per

cent of solidifier to solidify oil completely. However, some agents may take up to 200 per cent to by weight to finish the task. The major problems with solidifiers remain the lack of clear benefit from using the product, difficulties in actual use and the high amounts of agent required.

De-emulsifiers or emulsion breakers

Several agents are available to break or prevent water-in-oil emulsions. Most are hydrophilic surfactants. There are two uses for de-emulsifiers, one is on the open seas to break or prevent the formation of emulsions, the other is in skimmers or tanks to break recovered emulsions. Testing of some products has shown that they are effective on stable emulsions at agent- to-oil ratios as low as 1:500. Aquatic toxicities of these products vary considerably from highly to relatively non-toxic.

Surface-washing agents

Surface-washing agents remove oil from solid surfaces, for example beaches. Testing on some commercial products has shown that the removal rate for the 150 products tested varies from 0 to 55 per cent. Similarly, the aquatic toxicity varied over a wide range from extremely toxic to relatively non-toxic. The chemical ingredients of surface-washing agents might be classified into three groups: oleophilic surfactants, natural *d*-limonene materials and solvents. Solvents have not been successful because of their relatively high toxicities. Citrus extracts containing *d*-limonene are relatively effective, but have high aquatic toxicities. The least toxic and most effective products are those containing oleophilic surfactants.

***In situ* burning**

In situ burning has been used for many years in certain parts of the world, particularly Arctic regions, where the oil gets thickened by wind herding it into the ice. This process offers the advantages that the oil is removed and does not require disposal; not only that, but it can be removed at very high rates, thus preventing shoreline damage. Burning, under the right conditions, can be highly efficient and can remove most of the oil, leaving only a taffy-like residue which can be cleaned manually.

Most oils will burn at sea if they have a minimum thickness of about 2-3 mm and do not contain water in the form of stable water-in-oil emulsions. This minimum thickness implies that the oil must often be contained before burning. To this end, special fire-resistant booms have been designed. Fire-resistant materials such as lightweight ceramic cloth are used. Tests show that temperatures in the flames can reach 1,300° C, which poses a challenge to material selection.

Extensive work has been conducted on analysing the air emissions of *in situ* burning. The main concern is the release of respirable particulate matter in the smoke. These are particles with diameters of less than 10 μm, which can affect the human respiratory system. It has also been found that the ground-level concentrations of these fall below concern limits, although the smoke plume can contain particulate matter at concentrations that are a health concern for as far as 20 km from the burning oil.

In some circumstances manual clean-up is not appropriate, either because it is not possible to do it or because no resources are threatened. In the first case, conventional methods cannot be applied to oil slicks when they are far out at sea and under high sea conditions. Often in such cases no resources, such as bird colonies or shorelines, are threatened. Sometimes, the oil disperses naturally before conditions are suitable for a response. In other cases, such as when oil hits a salt marsh, clean-up may cause more damage than the oil.

In these instances the result is natural recovery, also called the surveillance and monitoring option. It is always necessary to monitor the track and position of an oil spill for a number of reasons, not the least of which is the public expectation that this be done. Several natural processes, such as dispersion, biodegradation and chemical degradation, assist in the clean-up of oil. On the shoreline, natural washing and removal occurs, as does some biodegradation. At sea, natural dispersion occurs.

Bioremediation is very popular at the moment, particularly because it is a "natural" process. Bioremediation has only limited application to certain oils and circumstances and is never as fast as hoped or needed. Extensive work on shoreline degradation was conducted during the *Exxon Valdez* oil spill and much was learned. This incident, in addition to extensive land studies and studies of the consequences of the Arabian Gulf spill, shows that light and medium crude oils can be degraded to a large extent on shorelines in as little as one year. This length of time may, however, be unacceptable because of the shore's use or concern that the oil may move off the beach to re-contaminate other areas. Many types of indigenous micro-organisms degrade certain oil components. These organisms preferentially degrade the lighter aliphatic oil components. Heavier oils, such as Bunker C, contain constituents such as asphaltenes and higher molecular weight aromatics that are resistant to degradation. Shoreline degradation can be enhanced by adding oil-soluble fertilizers—for example, fertilizing a light oil can remove a large percentage of the spill in as little as one year. Heavier oils cannot be appreciably degraded, with or without fertilizer.

Conclusions

Spill clean-up is a complex and evolving technology. There are many situations and environmental conditions that necessitate different approaches. Clean-up capability in quiet sheltered waters is very advanced, but techniques for open waters, especially in higher seas, require extensive development. New technologies continually emerge, but these only provide incremental benefits. Each new tool becomes part of the tool kit. Each technique has its specific uses and benefits. Chemical treating agents are part of this tool kit and will continue to play an important role in the future.

For more information, contact Dr. Fingas at the Emergencies Science Division, Environmental Technology Centre, Environment Canada, Ottawa, Ontario K1A 0H3, Canada (Source: *Chemistry & Industry*, 18 December 1995)

First environmental fact-finding ship launched

The first environmental fact-finding ship was formally launched on 7 February at the port of Masan, South Kyongsang Province, Republic of Korea. The 79 ton boat manned by 15 crew members is the first of four environmental task ships that the Environment Ministry will float by 1999 to tackle pollution of the waters. Ministry officials said the conductivity-temperature-depth (CTD) measurement equipment installed on the ships will serve as a vehicle to prevent sea pollution in light of the oil spillage accident and red-tide phenomena which had afflicted the nation's waters in 1995. (Source: *Newsreview*, 17 February 1996)

BALLERINA project

UNEP/GRID—Arendal and the Swedish Environmental Protection Agency have started the

development of plans for a Baltic Sea region environmental information network based on Internet. The initiative has been called BALLERINA, which stands for BALtic Sea Region On-Line Environmental Information Resources for INternet Access.

BALLERINA is intended to be a regional effort to share environmental information using the Internet/World Wide Web (WWW).

BALLERINA is meant to be developed as a co-operative effort among agencies and organizations which produce and disseminate environmental information about the Baltic Sea and its drainage area. The purpose is to provide coordinated, yet decentralized, access to various types of information of relevance for the environment of the Baltic Sea region to Internet users.

BALLERINA will improve communication and sharing of environmental information by providing a gateway on Internet/WWW. From this page it will be easy to find environmental information about the Baltic Sea and its drainage area. This sharing of information will foster cooperation in developing regional answers to the unique environmental and societal challenges facing the Baltic Sea and its drainage area.

BALLLERINA is primarily intended to serve the needs of those who use environmental information at the national and international levels of the Baltic Sea region.

In order to present and discuss the plans, a workshop was organized in Stockholm, 13-14 June 1996, at the premises of the Swedish Environmental Protection Agency. The purpose of the workshop was to discuss and provide guidelines on how to make the BALLERINA initiative the main gateway for environmental information on the Baltic Sea region on the Internet.

Further information is available from: Internet/WWW/http://www.grida.no/prog/norbal/ballerin/.

Information about the BALLERINA initiative Sindre Langaas, GRID-Arendal (Tel.: +46-8-161737; Fax: +46-8-158417; E-mail: langaas@grida.no.)(Source: *Helcom News No. 2*, April 1996)

Integrated Coastal Zone Management

By John R. Clark

In a world of rapid population growth and diminishing natural resources, each country must plan for economic growth in balance with resource conservation and environmental management if it is to make progress in health, food, housing, energy and other critical national needs. Such basic resources as fuel, water, fertile land and fish stocks are already in short supply in many countries, and their future prospects are in grave doubt.

In the coastal areas of the world, high population densities, linked with urban growth, expanding tourism and industrialization, pose major threats to natural resources and biological diversity. The effects of uncontrolled development are destabilizing ecosystems, changing land-use patterns, making communities vulnerable to seastorms, and creating demands on the ecological resources of the world that are not sustainable.

This situation is expected to worsen. The current coastal population is likely to more than double in a few decades while resource uses accelerate. Urbanization and tourism expansion will unavoidably lead to further pressure on water supplies and to irreversible changes in coastal environments. Growing amounts of gaseous, liquid and solid waste also jeopardize the future of marine, coastal and wetland ecosystems as well as threaten species' survival.

The transitional strip of land and sea that straddles the coastline contains some of the most productive and valuable habitats of the biosphere including reefs. It is also a place of natural dynamism where huge amounts of natural energy are released and a great abundance of life is nurtured. It is a place of high-priority interest to people, to commerce, to military, and to a variety of industries. Because it contains dense populations, the coast undergoes great environmental modification and deterioration through landfill, dredging and pollution caused by industrial and agricultural development.

The land can strongly affect the sea. Impacts on coastal ecosystems from terrestrial activity include industry and agricultural pollution; siltation from eroded uplands; filling to provide sites for industry, housing, recreation, airports and farmland; dredging to create, deepen and improve harbours; quarrying; and the excessive cutting of mangroves for fuel. The impacts affect community security (from sea-storms), tourism revenues, biological diversity, and natural resources abundance.

Where fisheries are important for food and income, the effects of pollution and the physical destruction of habitats can be crucial, particularly for those species depending on coastal wetlands and shallow nearcoast waters for breeding and nurturing of their young. In many parts of the world, the construction of dams has blocked the passage of marine species migrating to inland spawning sites.

The major resource systems of the coast have no equal on land. Coastal ecosystems and key coastal habitats—such as coral reefs and mangrove forests—are not only distinctive, but also extremely productive of renewable resources—protein food, tourist income, mangrove forest products, and other economic goods and services. These resource systems must be conserved to continue. Sustainable use is the alternative to resource depletion that accompanies excessive exploitation for short-term profit.

Unfortunately, the water's edge is also a place where competition and conflict among users is great and where governments have failed to develop special policies and programmes. The water influence not only establishes special conditions, but also dictates unusual and complex institutional arrangements. In most countries a great variety of agencies have interests in coastal waters, interests that are sometimes complementary but more often are competitive. An integrated coastal zone management (ICZM) programme is needed to coordinate all the varied interests in coastal resource uses.

Where use of coastal resources is concerned, Governments have the mandate to manage public commons wisely. In most countries coastal waters are considered "commons"; that is, they are not owned by any person or agency but are common property available equally to all citizens with the Government as "trustee". This is an age-old public right going back to the Institutes of Justinian: "*Et quidem naturali jure communia sunt omnium haec: aer aqua profluens, et mare per hoc litora maris*"—"By the law of nature these things are common to mankind: the air, running water, the sea, and consequently the shores of the sea". Further, this influential doctrine states that "no one, therefore, is forbidden to approach the seashore, provided that he respects habitation, monuments and buildings, which are not, like the sea, subject only to the law of nations."

To cope with the complexity of managing the coastal commons, many countries are now working out special ICZM strategies for compatible development and resource

conservation management that are for the good of the nation as a whole. ICZM is committed to advancing sustainable multiple use of coastal resources and maintenance of biodiversity through an integrative, multiple-sector approach. It may be initiated in response to a planning mandate but more often because of a crisis—a use conflict, a severe decline in a resource, or a devastating experience with natural hazards.

Environmentally planned development adds to the economic and social prosperity of a coastal community. Fisheries productivity, increased tourism revenues, sustained mangrove forestry and security from natural hazard devastation are among the practical benefits of coastal zone planning and management. This holistic approval is supported by "Agenda 21", the report of the Earth Summit Conference of June 1992, sponsored by the United Nations.

A major purpose of coastal zone management is to coordinate the initiatives of the various coastal economic sectors towards long-term optimal socio-economic outcomes, including resolution of use conflicts and beneficial trade-offs.

Because it operates at the water/land interface, every aspect of ICZM relates to water in one way or another whether making provisions for marine commerce, the ravages of seastorms, resource conservation or pollution abatement.

Because the special conditions of the coast have not always been understood and given due regard by development organizations, programme designers, economic planners and project engineers, there have been losses of revenue, jobs, food and foreign exchange earnings potential in many coastal countries that could have been avoided. The key is *unitary management*. The necessity is to comprehend and manage the shorelands and coastal waters together as a single interacting unit.

Most Governments have some variety of environmental, resource management and development control programmes. These may include pollution control, natural hazards management, biodiversity maintenance, environmental assessment, wetlands protection, and so forth. But these programmes are operated by a variety of agencies and are uncoordinated, with the result that each agency goes its own way. Nor is there much coordination with various private sector enterprises or with the recognized non-governmental organizations (NGOs). This non-coordinated and non-integrated situation is inefficient at solving coastal zone problems.

The current trend is towards more comprehensive and broadly integrated coastal programmes of the ICZM type. An effective comprehensive programme can be the major force in any country for maintaining coastal biodiversity for resolving conflicting demands over the use of coastal resources and for guaranteeing the long-term economic sustainability of the coastal resource base.

Traditional land-based or marine-based forms of management and planning must be modified to be effective for the coast at the transition between land and sea. But the place where the land ends is also the place where the knowledge and experience of most administrators ends. For example, seafood is recognized as a critically important resource—it provides more protein worldwide per capita (16.1 lb) than beef and mutton combined (12.2 lb). Yet economic planners take slight notice—perhaps because seafood production is a mysterious pursuit carried out far from cities and incomprehensible to most persons. Also, fisheries are variable and, in large measure, unpredictable and unprogrammable.

From the natural sciences point of view, the coastal area is an extremely complex, highly diverse and complicated system; a complexity that ensures a continuing high need for help from scientists in the coastal planning sphere.

[Ed. Note: *This article is based on the Coastal Zone Management Handbook by the author, recently published by Lewis Publishers of Boca Raton, Florida.]* (Source: *Sea Technology*, June 1996)

New tool tracks pollutants in water at low cost

Scientists at Columbia University's Lamont-Doherty Earth Observatory have developed a new and inexpensive tool to track the flow of waste and the related transport of chemicals, spilled oil, sewage and other pollutants.

The new method uses minute amounts of a non-reactive, synthetic gas called sulphur hexafluoride (SF_6). Scientists inject the gas into water in a controlled way and then trace its spreading and mixing patterns. Costing about a thousand times less than fluorescent dyes—the tracers most widely used today—SF_6 expands scientists' ability to visualize and predict the dynamics of moving water.

Using the gas, scientists can track how fast, how extensively, and in what directions soluble materials would flow and mix in water.

According to Lamont-Doherty scientists, SF_6 has a wide range of uses for applied environmental research as well as for basic research to study the dynamics of water bodies. The new tool could be used to aid in oil-spill clean-up efforts, to site sewer outfall pipes, to reduce pollution risks, or to track the fate of contaminants released into surface water or groundwater. It can be used to study ponds, groundwater, large water bodies, and even in the open ocean. (Source: *Sea Technology*, June 1996)

First big seagrass transplant

The world's first underwater harvester planter designed to transplant seagrass has undergone trials in Owen Anchorage, a body of water north of Cockburn Sound, West Australia. The prototype machine, ECOSUB 1, was commissioned by Cockburn Cement as part of its $6 million environmental management programme.

The programme calls for transplanting large areas of seagrass as part of the company's environmental management programme for dredging shellsand as feedstock for its annual production of more than one million tons of lime and cement.

The ECOSUB is 4.8 metres long, stands 2.8 metres high, weighs two tons and comes complete with two buoyancy pontoons which can be jettisoned. Direction is controlled by water jets. Its bottom tray, with a jagged cutting edge to cut the root mass, and hydraulically powered vertical cutting blades, can take out a sod measuring 750 mm long, 350 mm wide and up to 500 mm deep. The machine can hold six sods weighing nearly one ton in total.

Water ejected through two long vertical slits at the front of the machine parts the seagrass fronds to provide a path for the cutting blades. Rolling along on four wide tyres to minimize damage to plant life, the machine is operated by one diver using hydraulic power from an accompanying support vessel.

Seagrass has never before been successfully transplanted on this scale, but the team leader for the ECOSUB project, of Murdoch University, believes the harvester's ability to remove bulk sods which can withstand

hostile weather conditions will give the transplanted seagrass the best chance to overcome the barriers which affect large-scale rehabilitation.

ECOSUB was designed by Ocean Industries, whose basic revenue comes from all manner of underwater work, such as patching holes in ships' hulls, polishing propellers and building housings for, and repairing, subsea electronic equipment, mainly for the petroleum industry.

The ECOSUB project created special challenges—first, in gaining knowledge about the growth and survival habits of seagrass and then in figuring out what type of machine could cleanly transfer sods 2 km underwater from A to B.

If the prototype proves a success, the next step could be to build a machine capable of transporting 100 sods and having a rotating thruster for directional control. (Source: *Prospect*, June-August 1996)

F. COUNTRY NEWS

AFRICA

Angola

1,000-meter well

A key offshore area is Angola, where production is currently 180,000 bbl/d. Elf has been drilling the Girassol-1 well in 1,000 metres of water in block 17. In Block 3, where it already has six fields onstream, total investment between 1990-1999 is estimated at Fr 7.4 billion. The main features here are:

- Development of Cobo, Pambi, and Oombi Fields with drilling platforms COB F1, Pam F1, and Oom F1, and production platform COB P1;
- Enhanced oil recovery of the northern field using gas lift and water injection;
- Possible extension of facilities for future discoveries and requirements.

The $435 million COB P1 platform will become the production centre for the southern area. It will be bridge-linked to the existing Pam F1 (Pambi) drilling platform.

The 9,600 ton integrated deck left the Eiffel yard at Fos, fully commissioned, at the end of 1995. It was mated with the 4,500 ton jacket (built in Dubai and installed in November) through transferral from the barge *Giant 4* using a combination of jacking and ballasting. This method, in which the barge moves inside the jacket's eight legs, was considered preferable to having a crane barge lift the deck. The jacket was therefore designed specifically for this form of installation, with vertical sides to resist the stresses.

The deck has a production capacity of 24,000 m^3 of gas and will also process the gas from four main platforms. Later it is planned to bring Oombo onstream with the Oom F1 drilling platform tied back to COB P1. (Source: *Offshore*, May 1996)

Congo

N'Kossa Field to come on stream

The N'Kossa Field, 60 km off the Congo, will come onstream soon. In mid-March the completed, 220 metre long, concrete-hulled production barge was towed out from Fos in southern France to the field by two Smit tugs. The barge, with its six modules, is the centrepiece of the Fr 9.4 billion field development which also comprises two unmanned steel drilling platforms tied back to the barge. Oil and liquified petroleum gas (LPG) will be exported from two storage/offloading tankers.

Plateau production is forecast to reach 120,000 bbl/d and field life is estimated at 30 years. N'Kossa represents the deepest water depth development undertaken in the Gulf of Guinea. Water depths range from 150 m in the east to 300 m in the west, where the continental shelf drops suddenly away.

Elf has been a pioneer in the Congo and today operates over 65 per cent of the country's oil production. Offshore production started in 1972 with the Emeraude Field.

The Congo's output has risen steadily in recent years, currently exceeding 195,000 bbl/d. Without N'Kossa, production would have declined to an estimated 119,000 bbl/d in 1998. With N'Kossa, it should peak at 250,000 bbl/d in 1998. There is a southerly extension to the N'Kossa reservoir yet to be tapped and developed.

While N'Kossa is the largest field yet operated by Elf, there are indications that last year's Moho discovery in 800 m water depth will prove to be far bigger. Moho reserves could contain up to 600 million million bbl or more, compared with 440 million million bbl at N'Kossa.

A 1,000 km^2 3-DE seismic has since been shot over Moho and the surrounding area. An appraisal well is currently being drilled, with a further two likely next year. If these prove up the reserves, a fast-track development will take place, with a possible production start in the year 2000. (Source: *Offshore*, May 1996)

Kenya

Port of Mombasa

Berths 16 and 17 comprise reinforced concrete decks supported on tubular steel Mannesmann piles. Each berth is 183 m in length and averages approximately 21.6 m in width. They were constructed between 1971 and 1976 complete with transit and back-of-port sheds.

They were converted to container operations progressively in the 1980s by removing the sheds and substituting container-handling cranes for the original dockside cranes. The original complex embodied a full complement of water and oil bunkering services as well as electrical and telephone facilities together with drainage.

Over the intervening years the underside of the deck suffered damage through corrosion. A separate report in 1989 investigated this and Coode Blizard Ltd. was commissioned to extend this work leading to the design of a rehabilitation system and the preparation of bidding and prequalification documents.

Tasks included reviewing all available data in a field visit during which additional condition survey work was undertaken. A structural check was also needed, together with consideration of the possible provision of a cathodic protection system for the reinforced concrete deck. Estimates of cost for the rehabilitation work were required as part of the package.

During the field visit, the tests included delamination to determine areas of incipient corrosion, depth of carbonation of the concrete, depth of chloride penetration, cover to reinforcement, resistivity of concrete, electrical continuity and potential tests and detection of stray currents. The study concluded that the cheapest and most satisfactory solution would be to build a new deck using the old as shuttering and using the space occupied by stone filling and surfacing of the old deck to provide the construction depth needed for the new structure.

The design work encompasses total design and detailing of the new deck so as to cater for the services required together with the production of bidding documents and appraisal of tenders. Overall planning is such as to provide minimum disruption of container-handling operations as the work proceeds. (Source: *The Dock & Harbour Authority*, February/March 1996)

Mozambique

Coastal rehabilitation at Maputo

DHV Environmental and Infrastructure, the Netherlands, is currently supervising the rehabilitation of coastal works at Maputo. The works to be executed will protect the sea coast for a distance of about 10 km.

These will involve the repair and replacement of revetments, dune filling, shaping and planting, construction of rubble groynes about 200 m long and a slipway.

The original design was prepared in 1994. Both the construction and the supervision are funded by the Government of the Netherlands under a bilateral agreement with the Government of Mozambique.

The works are being executed by China Jiangsu International and are expected to be completed by mid-1997. The total contract value is about US$13 million. (Source: *The Dock & Harbour Authority*, April 1996)

Somalia

Foreign fishing now allowed

After several years of uncertainty, Somalia's waters are open to foreign fishing vessels. With the volatile political situation in Somalia, foreign vessel operators have been reluctant to take the risk of entering Somali waters because of the threat of hostile action and the increased premiums charged by insurance underwriters—despite the fact that, at certain times of year, fishing for tuna in particular is highly productive.

Recently, the government authorities in control of the coastline of Somalia have reaffirmed their control over the 200 nautical mile fisheries zone by a series of declarations.

Under the recent declarations, vessels with a licence to fish in Somalia will be allowed to carry out fishing activities without interference and will be guaranteed safe passage in accordance with the general principles of international law relating to the freedom of navigation and innocent passage in the territorial sea. In return for these guarantees, strict compliance with licence conditions will be expected, vessels will be required to submit data on catches at regular intervals and air surveillance will be operated for detection of non-licensed vessels.

Within the zone, the sole and exclusive right to issue licences, authorization and permits to foreign vessels and nationals for the conduct of fishing and related operations has been given to AFMET, a Somali company with offices in Somalia and England. AFMET will also be responsible for negotiating terms and conditions for access, including the level of fees and royalties, and will be carrying out surveillance of the zone. An important part of the exercise will be gathering fisheries data in order to build a better database of the resource.

The offshore fishery in Somalia is seasonal and, because of the political problems in recent years, scientific data on the resource is limited. Nevertheless, the area is known to be highly productive at certain times of year and good catches of high-quality tuna can be expected. Already a number of vessel operators have expressed strong interest in fishing in the Somalia zone and are making preparations to obtain the necessary permits.

AFMET's office can be contacted by fax at (+44-1596) 671573 (UK). All inquiries regarding licensing should be directed to this office. (Source: *INFOFISH International*, March 1996)

Africa: Intraregional markets for small pelagics and canned sardines

Africa's trade surplus in fishery products has increased from US$485 million to US$713 million in 1992 with total exports rising to US$1,608 million. This confirms the growing importance of the fisheries sector in the economies of a number of African countries.

Western and Northern African countries continue to dominate African fish trade. In 1992, these two regions respectively accounted for 35 per cent and 32 per cent of the value of the African seafood trade. The main products traded include frozen small pelagic fish, fresh and frozen high-value demersal fish and canned fish. There is also an active intraregional trade in cured fish.

Value of fish trade, 1992 (US$ million)

	Imports	Exports
World	45 451.9	40 275.6
Africa	895.0	1 608.0
North Africa	145.9	662.9
West Africa	389.2	515.4
Central Africa	143.0	24.5
East Africa	92.7	209.4
Southern Africa	142.2	295.8

Source: FAO Yearbook, 1992 and INFOPECHE.

While exports of fresh and frozen high-value demersal fish from the African region to European markets is gradually gaining prominence, the trade in frozen small pelagics remain by far the most important. The major sources of supply from the African region include Mauritania, Namibia, Angola and South Africa.

Despite the abundant supply of small pelagics from Namibia, notably horse mackerel, it did not feature prominently in exporting to other countries. Rather, importers prefer horse mackerel from the northern CECAF zone (Mauritania and Senegal) which have a high fat content.

The main markets for frozen small pelagics are Nigeria, Côte d'Ivoire, Egypt and Zaire. Cameroon, Ghana, Togo and the Congo also constitute important markets. Following the devaluation of the CFA franc in 1994, the immediate consequence was a sharp drop in fish imports by a number of francophone countries, notably Côte d'Ivoire, Cameroon and Togo. However, with fish remaining one of the cheapest sources of animal protein, the demand for fish has gone up again, and frozen fish imports are expected to pick up.

The high value fresh fish export trade has gained momentum since 1990. The important fresh fish exporters include Senegal, Morocco, Mauritania and Guinea. The Rungis fresh fish market in Paris, France serves as the main outlet for fresh fish originating from Senegal, Mauritania and Guinea. Markets for Moroccan fresh fish

are, however, diversified to countries like Spain, Italy, France and Greece. Major species traded here include sea-bream, grouper, red snapper, scorpion fish, John Dory and barracuda. Fresh fish fillets are exported in reasonable quantities during the winter season but this activity is discouraged during the summer months due to the heat, which causes rapid deterioration of the fillets.

The supply of canned fish to the African markets has been dominated by Morocco and Japan, but now other major suppliers are emerging. These include Namibia and South Africa from the African region and Thailand from outside the region. There are two distinct products—canned small pelagics, notably sardines and pilchards, which are destined to both the African and European markets and canned tuna targeted to the European market. The major canned tuna producers include Côte d'Ivoire, Senegal, Ghana, Madagascar, Mauritius and Seychelles.

Cured fish trade is a widespread activity involving mainly women. This activity is conducted mostly at the artisanal level and the key products traded here include: smoked sardine, smoked bonga, smoked and dried anchovy, smoked catfish, smoked tilapia, salted dried demersal fish, all from West and Central Africa; dried horse mackerel, dried dagaa, dried and smoked tilapia and other cured freshwater fish from Southern Africa; and smoked Nile perch, smoked tilapia, dried dagaa and other cured freshwater fish, from Eastern Africa.

Mauritania remains the leading supplier of frozen small pelagic fish to the African region. Of the 213,900 tons of the frozen small pelagics exported in 1993, two thirds were traded within the African market, underlying the importance of Mauritania's contribution to intraregional fish trade. (Source: *INFOFISH International*, March 1996)

AMERICAS

Argentina

Parana River

A contract has been awarded to Jan De Nul NV and the Argentinian company Emepa to undertake the deepening and maintenance of the river over a period of 10 years.

The contract involves deepening the river over approximately 800 km during a period of two years and upgrading the beaconing and buoyage to improve navigational safety. The contract has a value of about US$635 million.

Jan De Nul has mobilized three dredgers to undertake this project.

The volume of material to be dredged is estimated at 180 million m^3, of which 60 million m^3 will be excavated in the process of maintenance dredging over the following eight years. (Source: *The Dock & Harbour Authority*, February/March 1996)

Colombia

Port of Cartagena

HASKONING, in association with Europe Combined Terminals, Port of Rotterdam, recently carried out the following study for Sociedad Portuaria Regional de Cartagena:

- Evaluate the existing port facilities and operations, technical and commercial specifications for the purchase of a portal crane, development plan for the port infrastructure, container-handling equipment, existing and required organization and communication systems.
- Identify the required training programmes for organization, operations, administration, information and navigation.
- Prepare proposals to study the commercial potential of the port, to produce a master plan for the port infrastructure and to assist with the design, construction and installation of the portal crane.

The Sociedad Portuaria Regional de Cartagena has been in the process of transforming from a government-operated port to one operated by the private sector. The port authority has a plan to improve port efficiency, including the development of the Manga Terminal as an important container transfer centre for the entire Caribbean area. To implement this plan the authority has had to make important decisions on port layout and infrastructure, purchase of port equipment, organization, information and training.

Port of Buenaventura

HASKONING, in association with Universidad del Valle Laboratorio de Projectos Hidraulicos del Pacifico, recently carried out the following study for Sociedad Portuaria Regional de Buenaventura:

- Recommend the most feasible dredging method in respect of technical, economical and environmental considerations;
- Prepare conceptual designs for options to reduce the volumes of maintenance dredging in the port basin;
- Evaluate the technical, economical and environmental feasibility of the options to reduce maintenance dredging.

The port of Buenaventura is located in the Buenaventura Bay of the Pacific Ocean coast of Colombia. The port handles the major part of the country's import and export flows. The existing port basin and access channel have a water depth of between 10-11 m. To keep the port basin at this depth involves an annual maintenance dredging campaign amounting to 1 million m^3. The dynamic characteristics of the Buenaventura Bay morphological system not only influence the navigational accessibility of the port, but also the deposition of sediments in the port basin. (Source: *The Dock & Harbour Authority*, February/March 1996)

Guyana

Sea defence project

In association with Caribbean Engineering & Management Consultants Ltd., Mott MacDonald has been appointed by the Government of Guyana to carry out the detailed design and construction supervision of approximately 5 km of sea defences along the east coast of Demerara and Corentyne.

The works are being carried out as part of the Guyana Sea Defences Rehabilitation Programme funded by the Inter-American Development Bank (ADB). The Guyanese Government has set up an autonomous project execution unit to manage the implementation of the various sea defence projects financed by various donor agencies.

The Guyana coastline, some 430 km in length, lies generally from 0.5 m to 1 m below sea level. It is

protected by a system of sea defences amounting to 340 km in length. There have been several instances of breaches in the sea defences in recent years, leading to flooding and salinity of the coastal area. Funds have been made available by various donor agencies to undertake remedial works.

The design work includes, initially, inspecting the condition of the sea defences in the project areas and identifying the lengths to be rehabilitated in order of priority. The previous designs prepared for other sea defences in Guyana will be reviewed and modified if necessary for adoption on this project to take account of any financial or technical advantages. (Source: *The Dock & Harbour Authority*, April 1996)

Grenada

St. Georges Harbour

Posford Duvivier has been acting for the funding agents for a $6 million extension of the port. The works will consist of refurbishment of the existing quay using limper dam, the provision of some 200 m of new steel sheet piled quay to serve general cargo and cruise ships; and reclamation to ease congestion in the port.

The project is notable in that the works extend across a buried length of the lip of an extinct volcano. The consultant's design review is now complete and the project is ready for the award of a construction contract. (Source: *The Dock & Harbour Authority*, February/March 1996)

Panama Canal

Plan to expand capital programme budget

To ensure that the Panama Canal is equipped to meet future traffic demands and that quality transit service is maintained in the long term, the Panama Canal Commission Board of Directors approved a major plan to expand the capital programme budget for the next five years.

This will allow the Commission to increase canal capacity more rapidly by augmenting and speeding up the implementation of modernization and improvement programmes. Record-breaking traffic levels in fiscal year 1995 tested the Commission's ability to meet its longstanding commitment to shipping. Although traffic is expected to return to more moderate levels by the end of this fiscal year, annual growth of 2 per cent is expected over the long term with variations occurring on a year-to-year basis.

The canal's maximum sustainable capacity is 42 transits per day, but the current operating capacity is about 39—the maximum average daily transit level at which canal waters time can be sustained over 24 hours. Average canal waters time would increase well above this benchmark if the average daily transit level exceeds the operating capacity.

The accelerated modernization and improvement programmes approved by the Board will provide the canal with the structural changes needed to increase operating capacity to about 44, and maximum sustainable capacity to 50 transits per day, reflecting the Commission's commitment to guarantee the ability of the waterway to meet the transit demands of the next century.

The new five-year package of $129.6 million raises the total capital investment for fiscal years 1996 through 2000 by some 53 per cent, from $246.9 million to $376.5 million. The additional investment package significantly enhances the Commission's already large ongoing programme by providing funds for five major projects:

- Accelerating the Gaillard Cut widening programme;
- Augmenting the tugboat fleet;
- Designing and purchasing new lock locomotives;
- Enhancing and modernizing the vessel traffic management system;
- Modernizing lock machinery control systems.

For safety reasons, restrictions are imposed on certain categories of vessel traffic in the 13 km long Gaillard Cut, resulting in an entirely northbound traffic flow during the early daylight hours, an entirely southbound flow by the afternoon and a mixed flow during the remaining hours.

In July 1991, the Commission Board of Directors approved a long-range programme to widen the Cut from its existing 500 ft to a minimum of 630 ft along straight stretches and 730 ft at curves. After the widening is completed, many of the existing restrictions, including those limiting traffic flow to a single direction, can be eliminated, increasing the potential for a lock utilization of more than 90 per cent. (Source: *The Dock & Harbour Authority*, February/March 1996)

USA

Plans to generate power from the Gulf Stream

Plans to harness the enormous power of the Gulf Stream off the coast of Florida are not new. Back in 1974 a workshop was held to try and work out ways and means of extracting useful power from the concentrated current which flows northwards between the Bahamas and the east coast of Florida before heading out across the Atlantic.

In 1977, the Coriolis Project conducted some model tests, and in 1984 Nova Energy installed a small turbine in the Gulf Stream for a very short test period.

The problems in having power generation equipment located out in the open ocean have restricted development work, and these early trials suggested that the generation costs would only match or exceed those of wind power generation. Now, a new consortium is having a fresh look at generating power from the Gulf Stream, and it has some powerful partners and some new ideas.

The Naval Surface Warfare Centre already has a test centre in the area with short support facilities and cable connections out to an offshore site. This base will provide an economical location to test the current generating equipment. A second partner, the Harbour Branch Oceanographic Institution, specializes in ocean engineering and marine studies, and has spent 25 years studying ideas for harnessing the power of ocean currents.

The proposed turbine is a new concept of submarine electric ring turbine which has shown very high efficiencies in experimental tests. In this turbine, the stator of the generator is built into a nozzle which surrounds the rotating propeller unit. This propeller has no central shaft, but is supported by water-lubricated ball bearings on a peripheral ring. These bearings and the absence of a shaft means that no seals, which are often the weak point of an underwater system, are required.

The magnets built into the propeller and the stator units are totally sealed so that whilst the propeller and its bearings are open to the water the electrical side is sealed off. Developed originally as a thruster for ship control, this thruster demonstrated a 25 per cent efficiency increase over

other types, and the same efficiency is expected from the underwater generator.

Two of these turbines will be mounted on a hydrodynamically-shaped hull form. This hull form with its centre stabilizing fin and wing-like nozzle ducts will be moored by a single wire and designed to automatically maintain a constant depth under the surface. The units would be moored well below the navigating draught of large ships, and provision would be made for the units to be easily withdrawn for servicing. This would be required at regular intervals, mainly to remove marine growth which could interfere with the water flow through the unit.

Called Turbine Under the Gulf Stream (TUGS), this project has now reached the stage of development where prototype construction is the next phase. Research funding is being pursued for the project.

It is estimated that the total energy at one cross-section of the Gulf Stream is 25,000 megawatts. If just 4 per cent of this total could be harnessed by the TUGS system it represents around 2,000 megawatts, equal to a large land-based power station. There is potential for similar systems in other parts of the world where powerful ocean currents run close to the shore. This system could also have applications for harnessing the power of strong tidal streams where these underwater unit would replace the costly barrages which have been proposed and would have less impact on the environment. (Source: *The Dock & Harbour Authority*, April 1996)

National Oceanic and Atmospheric Administration (NOAA) ship Discoverer returns from data-gathering cruise

The National Oceanic and Atmospheric Administration ship *Discoverer* returned to Seattle, WA recently after completing a seven-month research cruise to help scientists determine the role of the oceans in regulating the chemistry of the atmosphere and thus the Earth's climate. Research operations spanned the entire Pacific Ocean from south of New Zealand beyond the Antarctic Circle to north of Kodiak, AK, and westward from Seattle almost to the Indian Ocean. "*Disco*" travelled nearly 40,000 nautical miles during the deployment; she provided the platform for two of the largest experiments ever conducted to determine the effects of atmospheric pollution on global climate and to understand the physics of climate change. (Source: *Sea Technology*, June 1996)

United States Coast Guard awards $4.2 million for vessel traffic system design

The US Coast Guard has awarded three separate contracts to Raytheon Co., Hughes Aircraft Co. and Lockheed Martin Corp. to compete in the first phase of a project to design a vessel traffic system (VTS) for the Port of New Orleans. The three contracts total $4.2 million and are phase one of the Coast Guard's VTS 2000 programme. This programme is designed to improve vessel transit safety in up to 17 major ports in the United States.

These contracts are a strategic investment in protecting the environment and promoting trade.

During phase one, the three contractors will independently develop designs for the Port of New Orleans. At the end of six months, a single system-integration contractor will be selected for phase two of the project, which could entail the construction of up to 16 other systems in major ports nationwide over a 10-year period. (Source: *Sea Technology*, June 1996)

US mandates satellite tracking for crude tankers

The US President has decreed that all tankers carrying exports of American North Slope (ANS) crude oil must be fitted with satellite-based position reporting equipment.

Ever since the Trans-Alaska Pipeline first began carrying North Slope crude from Prudhoe Bay to the Valdez Marine terminal, US law had prohibited its transport outside US territory.

Allowing ANS exports would offer producers an incentive to increase North Slope production by perhaps 100,000 barrels per day.

Four caveats on tankers transporting the oil were issued.

One of these was: "Export tankers [must] be equipped with satellite-based communications systems that will enable the [US] Coast Guard independently to determine their location."

This related to another mandate: that ANS tankers departing Valdez must sail a course 300 miles due south of Cape Hinchenbrook Light, then turn towards their Asian destination, all the while remaining outside the 200-mile Exclusive Economic Zone.

Alaska's highly ecologically-sensitive Aleutian Islands chain concerns both environmentalists and government, especially since the Great Circle Route slices through Unimak Pass, west of Kodiak Island. The ANS tankers are now prohibited from using this short-cut to Asia.

The presidential mandates led to a focus on the "satellite-based" surveillance requirement by creating the need to find a means of ensuring that tankers complied.

The four mandates were couched in general terms to allow appropriate enforcement agencies to determine which means would best do the job.

It appears that the favoured monitoring approach would be the mandatory use of an Inmarsat-C system with fully integrated global positioning system (GPS).

There were several reasons why a satellite, rather than a more conventional radar vessel traffic monitoring was wanted, and why Inmarsat-C/GPS was the favoured system.

A broad-based system was needed so that the ANS tankers could be tracked throughout the Pacific. This dictated satellite usage. It also made the Inmarsat-C system, with its generous Pacific Ocean region footprint, highly attractive to US authorities.

The ANS traffic would need Inmarsat-C capability to meet impending GMDSS requirements anyway, and the Global Maritime Distress and Safety System (GMDSS)-certified Trimble Galaxy was seen in Washington as an inexpensive way for operators also to comply with the export strictures.

US enforcers sought a system that they could quickly and easily re-program to transmit position reports automatically at variable intervals. Thus position checks could range from, say every 15 minutes when the tanker was off the Aleutian Islands or Alaskan mainland, then be remotely re-set to transmit perhaps only once or twice a day when further out in the Pacific.

Also attractive was that virtually the same capability envisaged by the US Coast Guard was already in use—and highly regarded—by the United States

National Marine Fisheries Service. (Source: *Ocean Voice*, July 1996)

Venezuela

Port of Caripito

NEDECO/HASKONING has been commissioned by LAGOVEN SA to carry out the following study:

- Design of two steel dolphins to replace two existing units and the selection of dolphin location according to international standards;
- Design of two access bridges between the dolphins and the land;
- Detailed engineering to fortify two existing dolphins, but if this proves to be not feasible, to design two replacements;
- Revision and fortification of the cargo platform on No. 3 pier;
- Drafting of technical specifications for the dolphin foundation piles.

The Port of Caripito is situated on the River San Juan which flows through vast mangrove forests. The sailing distance along the river to open sea is approximately 100 km. The first crude oil tanker arrived at the port in 1930, and at present it can accommodate tankers of up to 60,000 d.w.t. In 1991, plans were made to enable the arrival of tankers of up to 90,000 d.w.t., but some time after that dolphins started to tilt and two totally collapsed.

In 1994, LAGOVEN appointed NEDECO/ HASKONING to undertake consultancy services related to No. 3 pier.

The consultants executed geotechnical, structural and dynamic analyses of all the pier's dolphin system. Based on the results of these analyses it was concluded that two dolphins needed fortification and two dolphins needed to be replaced. The detailed design included the fortification structures, cargo platforms, access bridges, foundation piles and recommendations for the location of the dolphin replacements.

Puerto Cabello

De Weger has been commissioned by HCI Houston to undertake the detailed design of the access bridge, reconstruction of the deteriorated sections and the damaged elements caused by ship collision. The brief also includes the design for reconstruction of the auxiliary platform and repair of the concrete structure which has deteriorated due to environmental conditions. (Source: *The Dock & Harbour Authority*, February/March 1996)

CARIBBEAN

Barbados

Caribbean Port State Control memorandum signed in Barbados

Maritime authorities of 20 Caribbean States and Territories have agreed on a Memorandum of Understanding (MOU) on Port State Control. The Memorandum was signed on 9 February at a final preparatory meeting held in Barbados, bringing to a conclusion a two-year period during which an ambitious set of measures to improve the maritime administrative infrastructure of region States and territories were prepared.

The Caribbean MOU is practically identical to other MOUs on port State control which are in operation in other areas of the world, including the Paris MOU in Europe, the Tokyo MOU in the Asia-Pacific region and the Viña del Mar Agreement in Latin America.

The efforts in the Caribbean region to enhance maritime safety, the protection of the marine environment and living and working conditions on board ships have been actively stimulated by the IMO and the International Labour Organisation (ILO), and were financially supported by the Government of Norway. Practical input was also provided by representatives from existing MOUs and the International Association of Classification Societies (IACS). Representatives from Canada, France, the United Kingdom and the United States also cooperated in these efforts.

Preparations for the initiative started in December 1993. On that occasion, it was agreed that a comprehensive programme would be necessary which would not only focus on port State control but should also encompass the development of an adequate maritime administrative infrastructure in each participating region country, including putting in place national legislation to implement the requirements of international maritime conventions and setting up extensive training of personnel at all administrative levels.

During a second preparatory meeting in October 1994, further progress was made in the development of an MOU on port State control and in outlining an inspectors' training programme. The first Caribbean Ship Inspector Training Programme (CASIT 1) was delivered in the period April-November 1995. The main part of this programme was designed and delivered by Det norske Veritas on behalf of IMO.

The Caribbean MOU on Port State Control also covers port State inspections on ships below Convention size which trade mainly within the Caribbean region. A comprehensive set of regulations, the Caribbean Cargo Ship Safety Regulations, have been developed to provide port States in the region with a useful tool for inspecting ships which are often of traditional build. The Caribbean MOU, where applicable, refers to these regulations.

At the end of the Barbados meeting, the MOU was signed by nine countries: Antigua and Barbuda, Barbados, Dominica, Grenada, Guyana, Jamaica, Netherlands Antilles, Suriname, and Trinidad and Tobago. It is expected that the United Kingdom will sign the MOU on behalf of the following UK Dependent Territories in the Caribbean: Anguilla, Bermuda, British Virgin Islands, Cayman Islands, Montserrat and Turks and Caicos Islands. The signatures of the remaining five countries that were not yet in a position to sign the MOU in Barbados are anticipated. They are Aruba, Bahamas, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines.

The MOU will take effect for each maritime authority that, following its signature, has submitted a notification of acceptance of the Caribbean MOU. It was further decided that Barbados will provide the regional secretariat and that a regional information centre will be set up in Curaçao, with the assistance of the Netherlands and France. Efforts are now aimed at putting these structures in place.

The inaugural meeting of the Caribbean Port State Control Committee will be held in the Cayman Islands in October 1996. (Source: *IMO News*)

Jamaica

Kingston Harbour

Boskalis is currently working in this harbour for the Jamaica Port Authority. Begun in September 1995, the project calls for the widening and deepening of the access channel and deepening operations within the port area, including dredging in front of a container quay that is in the final stages of construction.

Some 2 million m^3 of soft materials will have been removed on completion by a trailing-suction hopper dredger and a cutter suction dredger. The cutter is being used in those areas that are inaccessible to the trailer. (Source: *The Dock & Harbour Authority*, February/March 1996)

ARAB COUNTRIES

Aquaculture activities in the Arab countries

Global aquaculture production expanded during the period 1984-1993 at an average annual compounded rate of 9 per cent. Total production of fish and shellfish in 1984 was 6.9 million tons while production in 1993 reached 16.3 million tons, an increase of more than 136 per cent.

The developing countries were the main producers. Asia was the main contributor with 85.8 per cent of the 1993 world aquaculture production, followed by Europe (7.3 per cent), North America (3.5 per cent), South America (1.5 per cent), the former USSR (1.1 per cent), and Africa and Oceania (0.4 per cent each). China produced just over half of the total world production (8.9 million tons) followed by India (1.4 million mt), Japan (0.8 million tons), and Indonesia (0.6 million tons).

The total aquaculture production in the Arab region, on the other hand, was about 22,000 tons in 1984 and increased to about 64,000 tons in 1992 and dropped to about 60,000 tons in 1993. This constitutes a negligible amount in comparison to world aquaculture production, but none the less it shows a progressive increase of about 200 per cent between 1984 and 1993. Production from aquaculture in the Arab countries is expected to increase in the near future, especially in the vast stretches of unutilized coastline in order to make up for the insufficiency of fish landed by the capture fisheries in most of the Arab countries.

Objectives of aquaculture

Aquaculture activities in the Arab region have the following objectives:

- Supplementation of the protein requirements of the population by making available at a reasonable cost an important food products, as well as the production of high value types of food for lucrative markets;
- Support of natural stocks of certain species by stocking lagoons, coastal waters, lakes, ponds, rivers, canals, etc., with fingerlings bred in laboratories or under controlled conditions;
- Development of coastal areas by establishing mariculture projects in these areas;
- Development of agrarian areas by making better use of the limited freshwater resources by culturing fish in these waters in addition to using them for agriculture;
- Creation of job opportunities for the unemployed;
- As a biological solution to some environmental problems. The grass carp, for instance, is being used to clear water canals or dams of weed plants; it has been estimated that a one-kilogram fish consumes about 45 kg of aquatic plants per year and one hectare of these water systems produces about 300-375 kg of fish per year. (Source: *INFOFISH International*, March 1996)

Lebanon

Port of Beirut

Posford Duvivier is assisting local consultants Rafik El Khoury & Partners with the refurbishment and extension of the port facilities. This is a major project funded by the European Union.

The works include the refurbishment of the port roads, pavements and services that have suffered considerably during the troubles and a 15 MW generating station to service the port. The project also comprises the provision of the Stage I container terminal project including onshore storage and handling areas for gantry operations, administration and amenity buildings, new terminal entrance complex and the raising and servicing of the existing quay and the provision of quayside crane rails.

These works need to be completed since cargo flows through the port are increasing rapidly to service the reconstruction works and expand consumer demand as peace returns to the region. (Source: *The Dock and Harbour Authority*, February/March 1996)

Beirut sea defence

Maunsell, in joint venture with Sogreah, has been commissioned by the Lebanese Company for the Reconstruction of Central Beirut (SOLIDERE) to undertake the preliminary design of 1.3 km of reclaimed seafront.

The reclamation is in deep water and the scheme, which incorporates two marinas within the sea defence structure, includes a submerged offshore breakwater in 20 m of water, designed by Sogreah.

Construction is expected to be completed by 1999. (Source: *The Dock & Harbour Authority*, April 1996)

Libyan Arab Jamahiriya

Port of Misurata

In a technical cooperation agreement with the National Consulting Bureau of Tripoli, Mott MacDonald is providing construction supervision for a major expansion project which is to be completed in 1996.

This comprises an oil products berth, a repair and ship lift facility and quay walls providing 2,100 m of additional berthing facilities for general cargo, container and roll-on/roll-off vessels. A number of buildings and associated infrastructure works are also being provided.

The quay walls are constructed from interlocking concrete blocks laid on a gravel-filled foundation trench dredged in the seabed. The dredged material from the trench and other areas was used for reclamation purposes within the existing harbour basin. (Source: *The Dock & Harbour Authority*, February/March 1996)

Mauritania

Nouadhibou

Mott MacDonald, in association with Sabour Associates of Egypt, recently provided consultancy services to the Ministry of Fisheries and Maritime Economy,

ranging from the preparation of design/construct tender packages through to construction supervision for the new fishing harbour at Nouadhibou (formerly St. Etienne).

Situated in the extreme north of Mauritania, the development incorporates over 500 m of concrete and timber floating pontoons restrained by tubular steel piles, designed to accommodate a potential of 450 fishing vessels landing an estimated 80 t of fish per day.

Access to the harbour is by a dredged channel from the large Baie de Cansado, and is protected by a breakwater to prevent longshore siltation of the channel. The harbour was created by dredging over 135,000 m^3 of material which was used to reclaim land for the onshore developments. Sheet piles tied back to anchor blocks built into the reclamation area were used to form the quay and the adjacent sloping faces are protected by stone.

In addition to the fish unloading quays, the facilities include water, ice, fuel, reception, space for sorting, cleaning and frozen/chilled storage of the catch, plus an administration and sales area. Repair and maintenance areas for the harbour including a boat lift have also been provided. (Source: *The Dock & Harbour Authority*, February/March 1996)

Oman

Coral reefs study

L.G. Mouchel & Partners Ltd. has been commissioned by the Sultanate of Oman to undertake a major study of coral reefs. An extensive field survey will be carried out early this year in order to avoid the difficult marine conditions of the monsoon period.

The results will provide the basis for a coral reef management plan. The consultants will also provide on-the-job training for local scientists. (Source: *The Dock & Harbour Authority*, February/March 1996)

Mahout fishing harbour

Mott MacDonald was appointed by the Ministry of Agriculture and Fisheries to undertake the study, design and construction supervision of a new fishing harbour at Mahout in the Gubbatt Hashish on the Arabian Sea coast of Oman.

The first phase of the project included the collation of metocean, environmental and economic data and appraisal of existing studies, reports, maps and aerial photographs, together with discussions with Ministry representatives and fisheries organizations. Representatives also visited the area to identify the most suitable alternative locations for development, hold discussions with local fishermen and representatives and assess the availability of local construction materials.

The Ghubatt Hashish is an inlet on the Arabian Sea coast which provides natural shelter for small craft, and it is believed to have been an important Omani harbour in the past. After completion of the site selection procedures, site investigations, mathematical modelling and preliminary designs, a final layout was approved which would employ a causeway across shallow water to provide access in suitable water depths with minimum dredging disturbance. (Source: *The Dock & Harbour Authority*, February/March 1996)

Fisheries development plan

As part of a 10-year Fisheries Development Plan, Coode Blizard Ltd. has been awarded contracts for the development of three fishing harbours in Oman.

Al Lakbi—Lakbi is situated in the Dhofar Region of the Sultanate and is largely underdeveloped. The present settlement is on open sea on the coastal plain beyond the plateau of the hinterland. The town is already an active fishing centre, but it has no harbour facilities.

The development includes, but is not limited to, breakwaters, jetties and wharves, unloading and loading facilities and berthing pontoons. Services provided include the review and analysis of previous studies, investigation into sources of construction materials, contract documentation and supervision of topographic surveys, bathymetric surveys and geotechnical investigation, mathematical modelling of the harbour, preliminary designs and feasibility report, technical viability report, economic evaluation, detailed designs, preparation of tender documents and supervision of construction.

The first phase of the works includes a breakwater and pontoons and minimum shore facilities. The second phase will comprise buildings, including administration offices, control room, gatehouse, and processing areas, and the infrastructure will include water supply, fire-fighting installation, storage facilities, navigational aids and all ancillary services. The third phase will include the implementation of trawler quays. Construction of the first phase is now under way.

Reysut—Coode Blizard has been engaged for the development of the harbour area of Mina Reysut in Salalah. The new fishery harbour is to be constructed inside the main harbour of Mina Reysut and will comprise jetties and wharves, unloading and loading facilities and pontoons.

Merbat—The existing fishery harbour at Merbat was built in 1986; it consists of a breakwater and a 50 m wharf.

Coode Blizard has been commissioned to provide floating and fixed jetties, new paved areas, administration and ancillary buildings and processing areas. (Source: *The Dock & Harbour Authority*, February/March 1996)

Sur fishing harbour

A major harbour is planed for Sur, which is about 150 km south-east of Muscat. The harbour will provide facilities for artisan and industrial fisheries, together with a dockyard to maintain the entire fleet of Omani trawlers. Provision will also be made for the future development of commercial shipping at the port.

The first phase of the project will include two rubble mound breakwaters, in total 2 km long in water depths of up to 9.5 m. It will also include some facilities for the existing fleet, but these will be deferred to a later phase. Construction of Phase I works is due to be started by Galfar Engineering & Contracting Co. LLC in joint venture with Asia Foundations & Constructions Ltd. over a two-year contract period. (Source: *The Dock & Harbour Authority*, February/March 1996)

Development of a new port

Acer Consultants Ltd. of the UK, in association with MAP SERVICES Pty Ltd. of Singapore, was appointed by the Ministry of Development, Directorate General of Macro Economic Planning of the Sultanate of

Oman to undertake a study into the development of a new port in Northern Oman.

Its broad objectives were to review and evaluate six pre-selected sites, taking account of previous studies, future traffic development, the potential of the existing Port Sultan Qaboos, and containerization and shipping trends. Outputs were to include the selection of the most appropriate site, assessment of the project's feasibility, examination of the possibility of private sector participation, means to improve the port's feasibility, and an outline implementation programme. (Source: *The Dock & Harbour Authority*, February/March 1996)

Saudi Arabia

Al Khaleej village project

This is a waterside residential and tourist village on Half Moon Bay, 30 km south of Dharhan. Some 250 houses and hotel, leisure accommodation and infrastructure facilities have already been built on the south coastline of this development. These facilities are already in use.

The current phase of construction involves the formation of a 760,000 m^2 man-made lagoon, together with associated shore protection, breakwater and beach works. On completion of the lagoon, a further 500 houses and hotel will be built along its waterside edge.

Formation of the lagoon is now around 70 per cent complete and all shore protection and breakwater works are expected to be finished within the 30-month contract period. The works also include raising the ground levels and substantial pre-load of soft silty ground over large parts of the site. (Source: *The Dock & Harbour Authority*, April 1996)

United Arab Emirates

Abu Dhabi

Cathodic protection project

Sir Alexander Gibb & Partners Ltd. is undertaking the design and supervision of the removal of cracked delaminated or chlorine contaminated concrete on eight of the existing wharves, the installation of a cathodic protection system and uniting to reinstate the beams with sound concrete.

Work was started by Costain Abu Dhabi Company in March 1995 and is due for completion in September 1997. (Source: *The Dock & Harbour Authority*, February/ March 1996)

Ruwai Harbour and Marina

Scott Wilson Kirkpatrick is currently carrying out a survey and preliminary design for a new 65 berth small boat harbour with floating pontoon moorings on behalf of the Abu Dhabi National Oil Company.

The work, which will entail dredging, breakwater construction and associated shore facilities, is expected to be tendered late this year. (Source: *The Dock & Harbour Authority*, February/ March 1996)

Ajman

Scott Wilson Kirkpatrick recently completed studies and design work to reprlace three existing general cargo berths with new deeper berths to take advantage of the proposed dredging of Ajman Harbour and entrance channel.

The $3.5 million project is being carried out for the Government of Ajman, United Arab Emirates. Tenders for the sheet pile quays were received and work commences shortly under supervision of the consultants. (Source: *The Dock & Harbour Authority*, February/March 1996)

Dubai

Dubai Ports Authority

Kier International is carrying out the reconstruction of coping beams, rock revetments and paving approximately 2.4 km long, along with Berths 16-30 at Port Rashid.

The project is scheduled for completion in November 1997. (Source: *The Dock & Harbour Authority*, April 1996)

Dubai Creek

Costain Dubai Company, part of Costain Middle East, has been awarded a £8 million contract by the Dubai Municipality to carry out improvements to the Creek—the Municipality's principal waterway.

The contract includes dredging, excavation and the replacement of existing sheet pile quay walls with precast mass concrete block quay walls at five wharves along the Creek. The contract also includes the construction of a registration building, office accommodation and facilities for a number of Dubai Government departments at the Report Wharf, one of the five new wharves. (Source: *The Dock & Harbour Authority*, February/March 1996)

Yemen Arab Republic

Port of Aden

The project involves the rehabilitation of an existing but disused bunkering facility. Coode Blizard Ltd. has been appointed to provide engineering and project management services.

The existing facility includes tanks, pumps, pipelines and buildings situated on a reclaimed area within the harbour. There is a mooring, discharge and bunkering facility situated on a concrete structure supported on piles within the port area and supplied by underwater pipelines.

The consultant's brief is to assess the existing facility and to report on the measures required to bring the tanks, pipelines and marine facilities back into use. This includes refurbishment of tanks, pipelines (most of which, need to be replaced), marine facilities including mooring dolphins and other anchorage buoys, and onshore facilities such as offices, pump-houses, stores and workshops.

Design work and procurement of materials and equipment is in hand, and a contract is in progress for repair of the tanks. Other contracts will follow for the mechanical, civil and electrical works. (Source: *The Dock & Harbour Authority*, February/March 1996)

Mokha & Hodeidah ports

Coode Blizard Ltd. has been engaged by the Hodeidah Port Authority to provide master planning, detail design and tender documentation for:

- An additional 300 m berth at the Port of Mokha to cater for 20,000 d.w.t. ships and to serve general cargo, container and livestock needs;
- An additional 300 m berth at Hodeidah Port to cater for ships of 25,000-30,000 d.w.t. and to handle

general cargo, containers as well as roll-on/roll-off cargo.

Master planning is complete for both ports and final design and contract documents have been produced. Tenders are expected to be called for very shortly.

The consultants were also commissioned by the port authority to lead as its engineering consultants for dealing with damage sustained to the main pier head at the Port of Mokha caused by the collision of a 14,000 d.w.t. ship. Inspection of the damaged structure both above and below water was carried out and recommendations were made for securing the pier head. Temporary repairs were designed and supervised by Coode Blizard. The designs for permanent repairs are to be prepared together with tender documents. (Source: *The Dock & Harbour Authority*, February/March 1996)

Port of Socotra

Acer Consultants Ltd. has completed reports on the proposed new port at Socotra—an island some 200 km north-east of Somalia—which is part of the Yemen Arab Republic.

Currently there are no port facilities on the land. The assignment included an initial study to determine the optimum type and location of port facilities to be provided and the detailed design and preparation of tender documents for the development.

In November 1993, a team comprising a senior marine structures design engineer, a senior geotechnical engineer and a specialist in maritime and coastal hydraulics visited Socotra. Following this visit, during which the team identified five possible locations for the new port, studies were made of vessel shelter from predominant winds and waves, geological data and preliminary indications of ground conditions as gathered from walk-over surveys.

In an inception report, further ground investigations and hydraulic studies were recommended and tender documents were prepared for these surveys. Simultaneous with the preparation of survey tender documents, a design report was prepared. This report included:

- A description of meteorological and climatic conditions, geology and geotechnical background and seismic activity;
- A review of existing and likely future cargo traffic requirements and a prediction of future shipping services; and
- A recommendation of the most suitable site for port development.

Survey results have been analysed and instructions have recently been received from the client to prepare tender documents for the construction of the port. (Source: *The Dock & Harbour Authority*, February/March 1996)

Fourth fisheries development project

Following their earlier cooperation on the project preparation phase of the Fourth Fisheries Development Project, Coode Blizard Ltd. and MacAlister Elliott & Partners were appointed by the Commission of the European Communities to undertake the consulting services for the project implementation phase.

This is divided into two parts—the civil engineering, to be carried out by Coode Blizard comprising development of the village fisheries facilities, and the technical assistance to be undertaken by MacAlister Elliott & Partners involving the provision of fisheries advisers and specialists to various government departments.

The project sites are seven towns and villages extending over a distance of 300 km from Mukalla to Sayhut in Hadramout and Al Mahara Governorates in East Yemen. Additionally, there will be a road linking the fishing villages of Fokum and Ras Imran, near Aden.

Consulting engineering services include additional surveys and investigations, design and preparation of tender drawings and documents, tender evaluation and assistance with contract awards and site supervision of construction which is now in progress.

Under this current assignment (project value £4.5 million) following the recently completed Third Fisheries Project, Coode Blizard will have been responsible for the design and construction supervision of facilities for 12 villages and towns on the southern coast of Yemen, extending from Ras al Ara in the west to Sayhut in the east—a distance of over 800 km. (Source: *The Dock & Harbour Authority*, February/March 1996)

ASIA

Australia

Satellite surveillance system

Two years after satellite surveillance was introduced in Australia, to track and monitor fishing vessels, the system is receiving a very positive response.

Perhaps surprisingly, the approval is coming not just from the fishery authorities but from the fishermen themselves.

In January 1994, the Australian Fisheries Management Authority (AFMA) introduced a system based on Inmarsat-C to monitor the movements of 30 boats fishing for Orange Roughy in the country's South-East Fishery (SEF). The SEF is an important fishery, with more than 70 species being fished by boats from four Australian states.

The fishing grounds range over a number of zones and several of the species are subject to catching quotas. The permits issued to boats allow them only to fish in certain zones and to catch a certain amount of fish. But the complexity of the fishery leaves scope both for genuine mistakes and deliberate misrepresentation.

Before the advent of the satellite tracking system, the only way AFMA could police the fishery was by boat or aircraft. Both proved costly and imprecise.

The satellite system was introduced in January 1994. It has three basic elements: the shipboard reporting unit, which is an Inmarsat-C with built-in GPS; the transmission medium—in this case the Inmarsat-C service offered by Telstra, Inmarsat's Australian signatory; and the AFMA base station, where position reports from the vessels are analysed and then superimposed on digitized marine charts on a graphic computer display. This allows any incursions made by boats into unauthorized zones to be spotted immediately.

At first, the skippers in the fleet greeted the system with suspicion and distrust. They feared an unnecessary and disruptive intrusion into their working routines. But now, after two years, they are joining AFMA in their approval of the system.

The big advantage for the skippers comes from the fact that the Inmarsat-C terminal can also be used for two-way communication with any fax or telex machine

ashore. Skippers have been using it not only to contact AFMA for clarification of rule and boundary changes, but also to keep in touch with their management ashore, liaising on matters such as vessel maintenance and local fish prices.

Most importantly, AFMA reports that compliance with the quota system has improved considerably since the system has been in place. Skippers now compete on their ability to catch fish and not their ability to avoid being caught if they cheat. (Source: *Ocean Voice*, April 1996)

College of Aluminium Training to be enlarged

Construction of a new 4,000 m^2 training centre, to be funded by both State and Federal Government grants, got under way in April at a site in Prince of Wales Bay, Hobart, adjacent to the International Catamarans Tasmania's main production facility.

The project represents a major expansion of the College of Aluminium Training, which has been managed by the Hobart Institute of TAFE since it was opened six years ago.

The chairman and managing director of the Incat group of companies has said that the project will give the yard a significant boost towards the training of its skilled workforce. The Centre is being expanded to enable Incat to meet future production goals of delivering a ship (ex Hobart and over 85 metres in length) every five to six weeks.

The new Centre, purpose-built and located at Prince of Wales Bay in accordance with Incat policy that training will be conducted on-site, is expected to open within 12 months. Facilities will include 50 welding bays, to cater for 400 apprentices and trainees. This enrolment figure is expected to be reached within two years.

According to Incat Tasmania, since establishment in 1990, the existing Centre has contributed significantly to Incat's broad skill base by multiskilling workers in two primary areas of aluminium welding and fabrication.

The training has been delivered in the form of on-the-job competency-based courses presented in internationally recognized modular packages. (Source: *Fast Ferry International*, April 1996)

Bangladesh

Port of Chittagong

During a recent cyclone, extensive damage was caused to jetties in the port. Coode Blizzard Ltd. has been engaged to undertake the design and works supervision of the repair and reconstruction of these jetties.

The work includes a new fendering system on six berths, replacement of damaged piles and structural repairs.

Jamuna River bridge

A bridge is being built across the Jamuna River, 120 km north of the capital Dhaka, to connect east and west Bangladesh. The total project involves the construction of a 4.8 km long bridge, river training works and the slip roads with the connecting highways.

HAM started on site in October 1994 in a joint venture on the river training and reclamation works. Completion of the project is scheduled for spring 1997. (Source: *The Dock & Harbour Authority*, February/March 1996)

China

China launches National Ocean Development Plan

China's State Ocean Administration recently released the first National Ocean Development Plan. The total output value from China's ocean development will quadruple by maintaining an annual growth rate of 11-13 per cent before the year 2000, based on the 1990 figure. By the year 2020, China is expected to rank among the top 10 nations in the world in terms of economic capability in ocean development, as per the plan. Marine pollution is expected to be controlled and coastal environment will be improved. The plan is set to implement integrated development of ocean and terrestrial resources to increase comprehensive effects of ocean development, to rely on an S&T programme and to pursue the harmony of development and environmental protection.

The plan outlines Chinese ocean development as:

- Building up a comprehensive ocean transportation system;
- Developing five kinds of resources, i.e. harbour areas, aqua products, offshore oil and natural gas, sea water and coastal tourism; and
- Promoting development in five areas: the Bohai-Sea Rim, Yangtze River outlet-Hangzhou Bay Area, Coastal area in South-East Fujian Province, Pearl River outlet and Beibu Gulf, so as to drive the integrated oceanic terrestrial development along the whole coastal area. (Source: *Tech Monitor*, January/February 1996)

Shanghai harbour

Maunsell Consultants has been engaged by Hong Kong International Terminals Ltd. to conduct a feasibility study of existing facilities, the need for upgrading and for new facilities. The work includes a review of some existing berths with a view to conversion of the facilities from break-bulk to container handling.

The consultants are also responsible for all aspects of technical assessment, including programming, costing for proposed dredging, reclamation, marine structures, building and infrastructural works required for the upgraded port at Waigaoqiao. (Source: *The Dock and Harbour Authority*, February/March 1996)

Zhuhai Gaolan Port

Maunsell acted as the technical consultant to a private client for the review of this port's development. The brief includes assessment of the previous studies carried out by various Chinese design institutes, and looking into different options to upgrade the port into a modern container port.

The consultants also gave advice to engineers from the First Design Institute of Navigation Engineering of the Ministry of Communications and an independent cost estimate of US$40 million to the client during the negotiation stage. (Source: *The Dock & Harbour Authority*, February/March 1996)

India

Port development, Andhra Pradesh

Further to initiatives taken by the British Government and the Indo-British Partnership, a Memorandum of Understanding was signed on 29 June 1995 by the Industrial Development Corporation of the Government of

Andhra Pradesh (APIDC), and an Indo-British consortium comprising Mott MacDonald, Tarmac Professional Services and Construction, Felixstow Port Consultants, Machen Development Corporation and Ashok Leyland Ltd. (the flagship company of the Hinduja Group in India for industrial and infrastructure projects).

Andhra Pradesh, which has one of the longest coastlines of any Indian State at over 1,000 km, has identified the improvement and expansion of its cargo-handling facilities as a fundamental requirement for continued economic growth.

Initial studies will examine the operational practicability and financial viability of selected port facilities in Andhra Pradesh. (Source: *The Dock & Harbour Authority*, February/March 1996)

Port of Ennore

HASKONING was commissioned by the Madras Port Trust in 1993 to undertake the detailed design of the first-stage development of this new port which will be used primarily to handle coal. On completion in 1999 Ennore, which is located 20 km north of Madras along the Coromandel coast on the Bay of Bengal, will be a satellite port of Madras—India's second port.

The consultants are responsible for the preparation of cost estimates, tender documents, prequalification of contractors, evaluation of tenders, the award of contracts and the supervision of construction in association with RITES of India. The estimated cost of construction to date is US$450 million and this is being funded by the Asian Development Bank.

Design work for the first-phase development involves the construction of two breakwaters with a total length of 3.8 km, two wharves totalling 550 m, dredging of an entrance channel and a basin to a depth of 15.5 m, coastal protection defences, onshore infrastructure works and utilities and the purchase of tugboats and navigational aids. Total cost of the first phase is approximately US$250 million.

The design vessel for the initial port development is 65,000 d.w.t. The port design allows for expansion to "Suez-max" size vessels. The two wharves will be used for receiving bulk carriers with coal from the Talcher coal fields. An annual throughput of 16 million tons of coal is expected. The present throughput of Madras is 28 million tons per annum.

Further development of the port may include facilities for LPG, various liquid and dry bulk commodities and containers. Ample space has been allowed in the designed layout for the provision of these facilities. (Source: *The Dock & Harbour Authority*, February/March 1996)

Trouble plagues Indian shrimp industry

Shrimp-farming development along India's coastline has been feverish. Ignoring advice to slow down and for a voluntary moratorium to contain the virus problem, entrepreneurs continued to import large quantities of seed and feed. As a result, the entire season's crop in Andhra Pradesh and Tamil Nadu was wiped out at the end of last year at a cost of US$63.8 million. Maharashtra, on the west coast, was also not spared.

Meanwhile, banks in India are reported to be unwilling to fund new ventures in shrimp farming following the industry's net loss for the last financial year and the poor results of earlier projects. Financial institutions say that they have funded 20 projects in the last three years; however, low returns mean aquaculture projects are now considered high-risk investments.

Farmers, on the other hand, object to what they consider as the shortsightedness of financial institutions. Shrimp farmers do, at least, have the support of the Central Government, which has listed aquaculture as a priority industry with the aim of attracting foreign investors to develop the country's shrimp sector. (Source: *INFOFISH International* 3/96)

Vessel traffic management system to be installed offshore India

A contract has been awarded by the Port of Bombay Trust—supervisory authority for India's largest port—for the design and installation of a proprietary STN Atlas Elektronik GmbH (Bremen, Germany) 9730 radar-based vessel traffic management system. The system is expected to begin service early in 1997.

Providing extensive 24-hour monitoring and control of all cargo and oil terminal traffic within the main port area and channel approaches, the system will comprise three strategically located X-band radar sites with dual transceivers and track-processing facilities at Colaba, Jawahar Dweep, and near the adjoining Jawaharlal Nehru Port Trust (JNPT) control centre on the eastern side of the port. The sites will be connected to two main control centres using a combination of microwave and fibre-optic links. (Source: *Sea Technology*, March 1996)

Indian ship-breaking runs aground

India's ship-breaking industry, which reached its peak in April 1994-March 1995, when it ranked as the largest in the world, has run aground in 1995-1996.

The country's ship-breaking is concentrated at Alang, a port in Gujarat on the west coast, which accounts for approximately 90-95 per cent of the tonnage broken in India. In 1994-1995, Alang broke 301 vessels with a total light displacement tonnage (ldt) of 2.17 million tons but during the 11 months from April 1995 to February 1996 this fell to 158 ships with a total ldt of 1.1 million.

It is noteworthy that growth, which was gradual from 1989 to 1994, almost doubled in 1994-1995. According to the Iron & Steel Scrap & Shipbreakers Association of India, such rapid growth witnessed in one year was unsustainable over a longer period. A number of factors are responsible for the recent fall and solutions for the situation will have to be found.

Alang Port is 52 km from Bhavnagar and has an 8 km shoreline with tidal variations of between 2 ft and 40 ft, which allows huge ships to be breached quite easily. Until 1983 a small amount of ship-breaking was carried out in Bombay and Calcutta but from that year Alang came to be used for its favourable beach for shipbreaking. In 1982-1983, five ships totalling 24,706 ldt were broken at Alang, but the number and tonnage increased year after year until in 1994-1995, it overtook China as the world's biggest breaker.

That record was achieved due to a change in Indian government policy. At first individual plot owners could break only 6,500 ldt a year, but after liberalization and the policy changes which then took place, plot owners were freed from such controls and could import whatever tonnage they wanted.

The scramble for ships by breakers in India and abroad has pushed up prices. The price of vessels available now ranges between $180 and $200 per ldt, up from $173

per ldt in 1993 and compared with $187 per ldt in 1994. This has affected the profitability of the industry adversely.

The intense competition and low profitability will drive some units to closure. The immediate cause of despair is the steep depreciation of the rupee against the dollar, from an average of Rs 31.50 a year ago to Rs 35 now. The forward premium on dollar cover is 22 per cent, which discourages importing on 180 days credit terms, while domestic interest costs have shot up to 22-24 per cent per annum, which makes importing risky.

The import duty on vessels for breaking is 10 per cent while it is only 5 per cent on imports of melting scrap. In addition, a local excise duty of 15 per cent on broken steel adds to the cost. A further disincentive is the fact that domestic prices of steel long products have been stagnant for a long time.

Due to strong competition for plots, the Gujarat Maritime Board has started charging a premium of Rs 2,700 per metre on plots from November 1995. The lease of a plot is for 10 years but the breakers want the lease to last for 30 years, so that they can invest in modernization to increase productivity.

Ship-breaking labour costs in India are said to be on a par with those in Pakistan, Bangladesh and China—the three main competitors.

Nevertheless, major investments in ship-breaking are already being made. A new port at Pipavav in Gujarat is to be set up by the Gujarat Pipavav Port Ltd. (GPPL) and partly financed by a Rs 1,750 million soft loan from Japan's Overseas Development Agency. Japanese technology will be used to break the ships. Land has already been allotted and it will take some years for plant installation; the yard will have a capacity of 1 millions tons per year. Some of the Japanese trading companies are likely to participate in ship-breaking, GPPL adds.

Shipbreaking at Alang

Year	No. of vessels	LDT
1989-1990	82	451,243
1990-1991	86	577,124
1991-1992	104	563,568
1992-1993	137	942,601
1993-1994	175	1,256,077
1994-1995	301	2,173,249
1995-1996*	158	1,096,000

Source: Gujarat Maritime Board.
* April 1995–February 1996.

At present the industry is in crisis. The existing units, as represented by their association, consider that they are viable if their demands are met. With the rupee getting weaker, interest rates rising, and the steel market remaining dull, it is market conditions that will determine the fate of Indian ship-breaking. (Source: *MBM*, May 1996)

Indonesia

Disease hits Indonesian farms

A virus epidemic and water pollution are reported to be posing a serious threat to Indonesia's shrimp farming industry, with widespread reports of harvest failures. Large areas of shrimp ponds have been abandoned as banks cut off credit and try to collect unpaid loans. Cold storage companies, which also act as exporters, have also been hit and 41 out of 104 companies are reported to have folded up, with another 30 facing serious losses. Farming accounts for some 60 per cent of Indonesian shrimp production.

Farmers in Brebes, one of the main production centres on Java, lost about two thirds of their harvest towards the end of 1995. They blamed government policies which allowed the development of industrial estates upstream from shrimp farms. Polluted waters are believed to promote shrimp killing viruses such as *Vibrio alginolyticus* and *V parahaemolyticus*. (Source: *INFOFISH International*, March 1996)

Republic of Korea

Shipbuilding industry sails along

For 1996, the shipbuilding industry in the Republic of Korea is expecting some good news and perhaps some not-so-good news. On the positive side, this could be a record year in terms of actual ships built, as work continues on the huge volume of backlogged orders which have accumulated over the past two years.

In addition, there are concerns that expanded world-wide capacity for bulk carriers and containerships will mean a drop-off in new orders for these vessels or downward pressure on bid prices. In fact, bulk carriers and container vessels accounted for the lion's share of new orders received by local shipbuilders during the past two years.

Still, not everything is negative. There are expectations of a surge in orders for oil tankers, in particular very large crude-oil carriers (VLCCs), as a result of a likely acceleration in the scrapping of older tankers now in service. Of note, new International Maritime Organization regulations which take effect this year require all tankers to be of double-hull construction.

The Korea Shipbuilders' Association (KSA), a private trade organization, forecasts that the domestic shipbuilding industry will receive new ship orders of about the same level as in 1995, an estimated 7.13 million gross tons (GT) for 194 ships valued at US$6.8 billion.

Surge in shipbuilding construction

In terms of actual shipbuilding construction and export volume, 1996 is very likely to be a record year, as local builders make full use of their expanded capacities. Actual shipbuilding volume is projected to reach seven million GT this year, representing a value of some US$6 billion.

A recently released report by the Korea Development Bank forecast that the local shipbuilding industry would record a slight decline of about 10 per cent in its facility investment this year, reaching 1.27 trillion won versus 1.42 trillion won last year. This decrease is to be expected as shipbuilders had significantly expanded their production facilities during the past two years.

Over the years, Korea's shipbuilding industry has capitalized on its lower-cost workforce, lower-priced and readily available steel, and the strong Japanese yen to steadily gain ground on their rivals in Japan. In fact, domestic shipbuilders use their competition with Japan's industry as a source of motivation for their management and rank-and-file workers.

As an indication of the dominance of these two countries in the world shipbuilding market, Japan's shipbuilding industry captured a 44.2 per cent market share of new orders in 1995, while Korea followed with a 31 per cent share. (Source: *Korean Business Review*, March 1996)

Korean shipping line moves into South-East Asian market

Korea Marine Transport Company (KMTC), an established player in container shipping in North Asia, is making a strong move to enter the South-East Asian market by launching a service to this region and forming a 50-50 joint-venture shipping agency based in Singapore with Jardine Matheson.

The company's inaugural Korea/South-East Asian service started recently. The fixed-day weekly service uses Singapore as a transshipment connection to link a North Asian leg covering Ulsan, Pusan, Keelung and Hong Kong to South-East Asia, which includes port calls at Jakarta and Surabaya in Indonesia, Klang in Malaysia, Yangon in Myanmar and Ho Chi Minh City in Viet Nam.

The company intends to further build up the service. It is currently deploying three German-built 1,122-TEU (20 ft equivalent unit) ships for the service and intends to upgrade the service to a twice-a-week frequency by increasing the fleet.

The moves will enable the Korean line, whose forte for the past 23 years has been in its Korea-Japan services, go gain a stronger foothold in the Intra-Asian trade. Eventually, EMTC also hopes to set up a dedicated feeder network and operation in South-East Asia.

Besides running a fleet of 20 container ships, KMTC operates its own port facilities in Ulsan in Korea. The company also provides both sea and air freight services, and runs car ferry services in Korea. (Source: *Shipping Times Online: Shipping News*, 23 May 1996)

Maritime ministry to be created soon

With the passage of a bill on government reorganization by the Republic of Korea National Assembly on 27 July, a ministry of maritime affairs will soon be created.

The new ministry, conceived in May, will take over maritime affairs from several government agencies, including the Ministry of Agriculture, Forestry and Fisheries.

The police force enforcing laws on territorial waters will move from the Ministry of Home Affairs to the new maritime ministry.

The planned launch of the maritime ministry faced problems when opposition parties threatened to block the bill while demanding a parliamentary committee be set up to match the ministry. This plan was later abandoned.

The National Assembly passed a dozen other bills, including one concerning the nation's exclusive economic zone (EEZ).

With the 200-mile-zone legislation, South Korea will soon start talks with Japan, which has put its own EEZ law into effect, on how to draw borderlines in overlapping sea areas. (Source: *Newsreview*, 3 August 1996)

Malaysia

Call to rationalize Malaysian port system

Malaysia's port system must undergo rationalization to prevent over-capitalization and over-capacity, according to a speaker at the recent "Third International Maritime Conference on Port and Shipping Asia: Challenges of the 21st Century" on Asian ports and shipping.

In order to minimize risk and maximize return on investment, the Malaysian port policy should adopt a formal strategy that designates a single facility as the national load centre while other ports serve as feeder ports. (Source: *Shipping Times Online: Shipping News*, 23 May 1996)

Myanmar

Japanese aid for Myanmar

According to the Japan International Food and Aquaculture Society (JIFAS), Myanmar has great potential for the development of a modern aquaculture industry. JIFAS is holding discussions and formulating plans for the development of Myanmar's entire fisheries, including aquaculture.

In its first project there, JIFAS is helping to establish a tilapia hatchery and grow-out farm near Yangon.

JIFAS has set up a Myanmar Fisheries Development Committee comprising 30 members. Subcommittees have been set up to look at all aspects of fisheries development in Myanmar. These include fisheries resources, feed production, aquaculture technology development, and processing. (Source: *INFOFISH International*, March 1996)

Pakistan

Port of Karachi

Scott Wilson Kirkpatrick was appointed by Karachi Port Trust as the lead consultants for the reconstruction of more than 800 m of deep water quay wall at the East Wharves. The project entails replacement of a partially collapsed quay wall and remodelling and upgrading the existing facilities to allow larger vessels, heavier cargo loading and gantry container cranes to be accommodated.

The end-product will be a 600 m long berth container terminal plus a multi-purpose general cargo and a roll-on/roll-off berth built to a new alignment, avoiding the operating constraints imposed by the previous layout. In addition to a new piled quay wall designed for a declared water depth of 12.8 m, the project includes dredging and reclamation, removal of the collapsed structure, demolition of two transit sheds, removal of railway track, paving and quayside ship-shore services.

The firm is currently providing consulting services which include layout planning, direction of site investigations, advising on hydraulic modelling, feasibility studies, detailed design, tender documentation, evaluation of tenders and construction supervision.

Port of Gwadar

Posford Duvivier, in association with Gifford & Partners and Techno Consult of Pakistan, has been appointed to plan and design a new deep-water port at Gwadar in the west of Pakistan.

This port will provide a strategic alternative to the existing ports at Karachi and also provide a natural outlet to Balochistan and CAS trades. Construction of the first stage, comprising three berths, reclamation and a dredged channel, is planned to commence later this year. The estimated cost of the Phase I works is US$200 million. Further phases will be let as build-operate-transfer (BOT) or build-operate-own (BOO).

National ports master plan

Port master planning and management studies for the Government of Pakistan have been carried out by Posford Duvivier under funding from the Asian Development Bank. The Posford Duvivier team worked in association with Techno Consult of Pakistan, Portia Management, Hydraulics Research and Steer Davies Gleave.

Karachi provides the historic and trading port while Qasim, developed in the early 1980s, caters predominantly for the bulk trade. The team undertook a critical review of the port sector with a view to rationalizing investment. This led to the preparation of an investment plan, including the recommendation of measures to attract private sector participation in their financing.

Options for a third deep-water port were investigated in the study, including that of Gwadar. Recommendations concerning the management of the existing ports were also made. The draft final report was submitted in November 1995. (Source: *The Dock & Harbour Authority*, February/March 1996)

Philippines

Indexing the world's known species—Species 2000

Representatives of 18 taxonomic and species diversity databases met in mid-March at a United Nations Environment Programme workshop to give the formal go-ahead for the program "Species 2000" which had been planned by the International Union of Biological Sciences (IUBS), the Committee on Data for Science and Technology (CODATA) and the International Union of Microbiological Societies (IUMS). The program to provide an index of the world's known species was initiated in March 1996 in Manila, Philippines. The Species 2000 program will enable users world-wide to verify the scientific name, status and classification of every known species of plant, animal, fungus and micro-organism, of which there are about 1.75 million in the world. The existing global species databases may presently account for some 15-20 per cent of the total. The workshop was organized by the Species 2000 Secretariat at the University of Southampton, UK and hosted at the International Centre for Living Aquatic Resources Management (ICLARM) in Manila. For further information, contact the Species 2000 Secretariat, School of Biological Sciences, University of Southampton, Southampton, SO16 7PX, UK. (Tel.: (44-1703)592444. Fax: (44-1703)594434. (Source: *INFOFISH International*, March/96)

Shipping vital to long-term stability of the economy

In archipelagic countries like the Philippines, the movement of trade is concentrated on water transport. In fact, about 95 per cent of all goods move through sea transport routes, with land transport providing the complementary routes.

Within this context, therefore, the shipping industry is a vital factor to economic performance.

As the Philippines enters the third millennium, it has become more evident that its long-term economic survival hinges on how well it could plan and subsequently work out a realistic shipping industry development plan.

While air transport has been taking in a bigger share of cargo transport, it cannot definitely compare with sea transport especially in international trade.

With the strategic location of the Philippines in the Asia-Pacific region, a well-developed maritime industry is a must if it intends to become the dominant transaction and transshipment centre in this part of the world.

A recent paper on possible development paths cited three areas wherein the country could develop into centres of excellence. These include information technology, bio-technology and the medical sciences, and marine sciences.

Marine sciences include not only the development of fish capture and raising technology but also sea transport. Already, strides have been made in the production of small seacraft, particularly leisure boats, for the export market. In addition, the shipyards near Metro Manila have been sprucing up to accept repair and maintenance services for big ocean-going ships, including tankers and bulk cargo carriers.

While the Government has, for its part, deregulated the industry to spur competition, still much more has to be done. For example, it has to review its incentives programme on the acquisition of new vessels both for domestic and international use. As an aftermath of the successive sea tragedies during the past two years, the Government also has to improve its monitoring and enforcement capabilities to avoid a repetition of these disasters in the future. According to figures, an average of 200 mishaps occur in the local seas yearly involving small boats up to large passenger liners.

The National Economic and Development Authority (NEDA) has approved a scheme to assist the local shipping industry through concessional financing. This should enable the industry to restructure its fleet with safe and modern vessels. The financing plan liberalizes lending by making available long-term capital at special interest rates and easier repayment terms.

Before 1992, much of the local shipbuilding and ship repair industry had been in the doldrums, as no new orders were placed. Local companies had preferred to import second-hand ships from Japan. As a result, ship repairs were the main activity of local shipyards before the deregulation of the industry.

Ship repair facilities, which have an average capacity of 5,000 deadweight tons, have been fully occupied during the past few years. The bulk of those being serviced were foreign vessels as well as local fishing fleets.

The Government has finished a policy study on vessel replacement and retirement in coordination with the Philippine Shipbuilders and Repairers Association (PHILSAR). This study sought to support replacement of old and ageing vessels and to contribute to the rehabilitation of the industry itself.

Through the Maritime Industry Authority (MARINA), the Government has encouraged the testing of indigenous materials for shipbuilding purposes. It has, in fact, completed the construction of a prototype ferrocement vessel using 100 per cent indigenous materials for its

frame, hull and other ship parts. (Source: *Philippine Development*)

Charting the growth of the Philippine economy

Efficient sea transport is vital to the growth of the Philippine economy. The need to modernize and expand the Philippine merchant fleet and to rationalize and improve their operations is thus needed to make it an effective instrument in promoting domestic production, inter-island and overseas trade, stabilizing prices and creating jobs.

These are the premises upon which Presidential Decree (PD) No. 474 was founded. This decree, promulgated in 1974, created the Maritime Industry Authority (MARINA) to implement and pursue the national policy on sea transport.

MARINA is attached to the Department of Transportation and Communication (DOTC) and is tasked with promoting and developing domestic shipping, including the shipbuilding and repair industry. It regulates the issuance of franchises for transport services and shipping routes, approves the acquisition of new vessels, and prescribes shipping and passage rates.

At present, the Authority also undertakes maritime safety functions, tasks previously undertaken by the Philippine Coast Guard. It thus conducts ship inspection and certification for seaworthiness, vessel registration, and issuance of Seaman's Books. MARINA's jurisdiction generally covers: (a) domestic shipping; (b) overseas shipping; (c) shipbuilding and repair; and (d) maritime manpower development.

Assisting MARINA is the Philippine Ports Authority (PPA) which was also created in July 1974, under PD No. 505. PPA is tasked with implementing the State policy of an integrated programme for the planning, development, financing, operation and maintenance of ports or port districts, for the entire country.

Shipbuilding and ship repair

The shipyard industry in the Philippines is concentrated around Manila and Cebu, the two areas which show greatest potential. According to the Philippine Shipbuilders and Repairers Association (PHILSAR), there are 83 shipyards in the Philippines today which have registered with MARINA. Sixty-one—or 73.5 per cent—of them are below 1,000 gross registered tonnage (GRT) in capacity, 20—or 24.1 per cent—range from 1,000 to 19,999 GRT and two have capacities of over 20,000 GRT.

Of this total, four are primarily engaged in new building, 67 are in both shipbuilding and repair, and 12 are engaged in shipbreaking. Apart from these, there are also a total of 88 registered afloat repairers.

Other problems that hinder the development of the shipbuilding industry in the country include: (a) the lack of incentives; (b) preference of local ship owners for imported second-hand vessels; (c) absence of well-developed ancillary industries that support the shipbuilding sector, such as an integrated steel industry; and (d) lack of equipment and poorly trained manpower.

Challenges ahead

The Philippine inter-island shipping industry is faced with various problems which have been categorized into four major areas of concern, namely: (a) safety; (b) cost and adequacy of shipping services; (c) cost and efficiency in port services; and (d) institutional issues.

On **safety**, the industry is most concerned with the limited competence of vessel crew members and the fact that vessels are inadequately equipped and maintained. It is also incapacitated by outdated/inapplicable maritime regulations and inadequate manpower complement in regulatory agencies.

On **cost and adequacy of shipping services**, the industry is currently faced with problems which include: (a) the low returns from operations; (b) unrealistically low rates for basic commodities in favour of higher-rate products; (c) high investment and operating costs; and (d) regulatory constraints on routes and fares resulting in restrictions on the entry of shipping lines on routes inadequately served by existing franchise holders.

On **cost and efficiency of port services**, there are poor and inadequate port facilities and a one-port-one-operator policy. The restricted competition in services results in high service costs.

On **institutional issues**, there is a lack of integrated/coordinated effort in planning and operations among different agencies as well as a lack of post-disaster relief assistance to victims (and their relatives) of maritime accidents.

To better respond to the concerns of the **overseas shipping sector** and to further previous initiatives by the Government, MARINA's overall development goal for the sector is to enhance competitiveness of Philippine-flag vessels in the carriage of the country's foreign trade.

For the **shipbuilding and ship repair sector**, the following overall development goals have been identified: (a) development of a shipbuilding and ship repair sector capable of meeting the modernization programme of the Philippine merchant fleet and the national Government's vessel requirements and having adequate resources and facilities for the construction and repair of foreign vessels; (b) a modern shipbuilding and ship repair sector with technical expertise based on a properly oriented research and development (R&D) programme; (c) a competitive shipbreaking sector that would promote the Philippines as a shipbreaking centre in the South-East Asian region; and (d) a favourable business climate that will attract foreign investments to the industry. (Source: *Philippine Development*)

Sri Lanka

Development of Colombo's container facilities

The Peninsular & Oriental Steam Navigation Company (P&O) and its local partner, John Keells Holdings, has been invited by the Government of Sri Lanka for detailed negotiations to develop the container facilities in the Port of Colombo.

This gives the partners a preferred position for the development of a major port that will be of considerable long-term importance for container shipping in the area.

The capital required for the first phase, to enhance the existing berths at Queen Elizabeth Quay, is expected to be around US$220 million. P&O and John Keells Holdings will hold the majority of the equity of the joint venture company being established to carry out the project.

The new company will have a long-term lease on the new port as well as the management contract. It is anticipated that by the year 2000 the three berths will be able to handle an additional 750,000 TEU.

Further phases of the project are expected to involve the construction of a new breakwater with associated dredging and the progressive development of berths in the outer harbour in the period 2000-2005. The eventual handling capacity of the new terminal facilities could exceed 3 million TEU. Aid agency funding will be required before the second phase of construction can proceed. (Source: *The Dock & Harbour Authority*, April 1996)

Viet Nam

Port of Cai Lan

HASKONING recently completed a study for dredging, widening and deepening the access channel and turning basin at the port.

This study was commissioned by the Dutch Ministry of Transport, Public Works and Water Management and the Port & Delta Consortium BV, the Netherlands. HASKONING worked in association with Vietdredge and Transport Engineering Design Inc. (REDI), Viet Nam.

The assignment comprised assessment of the quantity and type of material to be dredged, dredging equipment and methods of implementation, execution time and cost estimates. It also included the drafting of specifications to mitigate environmental damage resulting from the dredging operations, transportation and disposal system along with the selection of dumping areas.

A two-dimensional mathematical hydro-dynamic and mud transport computer model was used to calculate the sedimentation in the access channel, including the collection of hydrographical and morphological data for model calibration.

The development plan for the Port of Cai Lan, which is located in Bai Chay Bay, includes the construction of seven berths for container, bulk and general cargo handling. The access channel starts at the Gulf of Tonkin and runs through Ha Long Bay, Cua Luc Strait to Bai Chay Bay. The channel is sheltered from the direct influence of the sea by a multitude of small islands.

The design criteria for development of the port are based on a cargo vessel of 40,000 d.w.t. with a draught of 12 m. This means that the approach channel has to be deepened by 3-4 m over a length of 10 km and with a width of about 130 m.

The Cai Lan area has a number of ecologically sensitive elements such as mangrove forests and coral growth and has an important tourist value including scenic beauty, while its fishery resources represent a major ecological/socio-economical interest. For these reasons the consultants placed great emphasis on the long-term environmental consequences resulting from the large-scale dredging operations involved in enlarging the Cai Lan access channel. (Source: *The Dock & Harbour Authority*, February/March 1996)

East-west corridor study

Maunsell Consultants has been engaged by the Asian Development Bank to carry out a study of transport corridor options from Thailand through Laos to a seaport in central Viet Nam. (Source: *The Dock & Harbour Authority*, February/March 1996)

EUROPE

Denmark

Sweden-Denmark tunnel

Measured by volume, the 3.7 km long immersed tunnel that will form part of the fixed link between Sweden and Denmark will be the largest such tunnel in the world.

It is being designed and constructed at a cost of DKr 3.8 billion by the Öresund Tunnel Contractors, a fully integrated joint venture comprising NCC AB of Sweden, DUMEZ-GTM SA of France, John Laing Construction Ltd. of the UK, E. Phil & Son AS of Denmark and Boskalis Westminister Dredging BV of the Netherlands. The contract was awarded in July 1995 and is scheduled to be completed in the year 2000.

Casting of the 20 prefabricated reinforced concrete elements—each 175 m long, about 40 m wide and more than 8 m high—began this summer. The 50,000 ton elements—requiring in total more than 700,000 m^3 of concrete—will be fabricated at a temporary yard in the Copenhagen area and towed to the tunnel site where they will be immersed (commencing 1997) in a pre-dredged trench and then protected with rock armouring.

The tunnel will run from a man-made peninsula near Copenhagen to an artificial island located south of the Danish island Saltholm. It will carry a two-lane motorway in each direction, together with a twin railway track. A service gallery and internal walls will separate road and rail traffic moving in opposite directions.

The construction of approach structures, comprising *in situ* reinforced concrete portal buildings and ramps, also forms part of the contract, along with all electrical and mechanical installations, all road works and installation of the tunnel railway tracks.

An extensive system of controls will be installed to monitor and regulate quality, health, safety and the environment. The latter was the subject of a detailed analysis which will form the basis of the operational guidelines and instructions.

Together, the members of the Öresund Tunnel Contractors have experience of working on more than 20 immersed tunnels world-wide. (Source: *The Dock & Harbour Authority*, February/March 1996)

Finland

Port of Kokkola

Almost 2 million m^3 of material is in the process of being removed from the access channel to this port. Reclamation is also taking place to extend the berthing and port storage areas.

Not due for completion until well into 1997, the project is being undertaken in joint venture by Sweden's Skanska, Boskalis Oosterwijk of the Netherlands and Finnish contractor Terramare.

A drill barge plus backhoe and bucket dredgers will be engaged on this major project, together with the trailing-suction hopper dredger *WD Gateway* which, having spent several years involved in the construction of man-made islands in Canada's Beaufort Sea, is well accustomed to the

Arctic-line conditions experienced in this part of Scandinavia. (Source: *The Dock & Harbour Authority*, February/March 1996)

Ireland

Marine industry

Ireland's marine industry is a complex mix of various activities—commercial sea fishing, fish processing, aquaculture and seaweed cultivation—all with their own characteristics and defining influences. Although each is ultimately dependent on the sea, they all have their own story to tell.

The two biggest segments, sea fishing and aquaculture, enjoy contrasting fortunes. Aquaculture is growing vigorously: although a relatively young industry, it is now responsible for one quarter of the total industry output. Fishing remains the biggest sector by far, but growth is largely static, constrained by EU quotas on fish catches.

The apparent complexity of the Common Agricultural Policy (CAP), is a mere bagatelle when compared with the labyrinthine intricacies of the EU's Common Fisheries Policy (CFP). Each member country with a fishing fleet has an agreed percentage of every year's "total allowable catch" for each quota species.

A report earlier this year, setting out the proposed Irish quotas for 1996, listed 13 species of fish, some of which are further subdivided into different varieties, each with separate quotas. Four varieties of herring are specified, for example, as are three of whiting and five each for plaice and sole.

The CFP, put in place in 1983, has not been kind to Irish fishermen. Irish fisheries organizations regularly point out that Ireland's territorial waters comprise 16 per cent of the EU's fishing grounds, yet Ireland only enjoys 4 per cent of its quotas. Less than one tenth of the estimated £2 billion worth of fish caught in Irish territorial waters each year is taken by Irish boats. Over 90 per cent is taken by foreign fleets.

The principle of "relative stability", which formed the basis of the 1983 CFP, then fixed the percentage shareout of the total catch that each country would get. Each country's historic fishing performance was used as a benchmark against which these percentages were set.

The total allowable catch is fixed each year, according to available scientific data on the state of the various fish stocks. Percentages can be adjusted somewhat to take account of the Hague Resolution and other derogations that other countries may have. The aim is to maintain stability in the fish stocks: from an ecological standpoint, the stock must be allowed to renew itself; while from an economic standpoint fishing, like any business activity, needs stability rather than boom and bust. Inevitably, however, the accuracy of the baseline data is questionable, given the difficulties associated with compiling the information.

Although Ireland has received £12 million in aid from the EU to develop its fisheries protection efforts, it is extremely difficult to obtain evidence of wrongdoing, aerial surveillance and global positioning satellite systems notwithstanding.

Policy review

The CFP is due for review in 2002. Already some organizations are calling for the policy to be scrapped.

The terms of that review have already been defined, however, and it will take substantial political effort to change them.

It would be wrong, though, to cast a pall of doom and gloom over the entire industry. While the demersal fleet, based around the south-west coast, especially Castletownbere in Co. Cork, is ailing, the pelagic fleet, which fishes out of Killybegs in Co. Donegal, is thriving and has undergone considerable investment and modernization in recent years.

The two fleets are not competing, at least not for fish, although one could say that they are vying for political favour. The Killybegs pelagic fleet fishes for mackerel and herring, both low-value, high-volume commodity-type catches, which swim relatively close to the ocean's surface. The demersal fleet catches lower volumes of the more valuable species, such as cod, whiting, haddock and hake, that live near the seabed.

Pelagic fisheries account for 71 per cent of volume and 24 per cent of the value of the total catch landed here, whereas demersal fisheries account for 17 per cent of the volume and 45 per cent of the value.

The Killybegs fleet, a small but highly efficient fleet of modern vessels, includes the massive factory trawler *Veronica*. This one ship, with over 5,000 GRT (gross registered tonnage), constitutes around one tenth of the entire Irish fishing fleet's total.

The issue of tonnage is tightly linked to fish quotas. The term does not refer to mass, but to an arcane measurement that has its origins in the Anglo-French wine trade of medieval times. To compound matters, it is calculated differently from country to country. Nevertheless, it is accepted as a "surrogate measure of fishing capacity".

As part of the EU's efforts to maintain fish stocks, countries are being asked to reduce their total tonnage. Ireland is faced with a 4,000 GRT reduction this year. Some trawlers will therefore be decommissioned and their owners presumably compensated.

Aquaculture

The aquaculture sector—finfish farming and shellfishing—has expanded considerably in recent years. According to the Government's Operational Programme for Fisheries, published in 1995, the value of its output rose from £27.7 million in 1989 to £40.4 million in 1992. France is Ireland's main market for aquaculture products, taking half the output in 1992, although Germany, the UK and the Benelux countries are increasingly significant markets.

Both finfish farming and shellfishing are largely concentrated off the coasts of Cork, Kerry, Galway, Mayo and Donegal. Inland freshwater trout farming, the sole exception, is mainly carried out in the south-east. Salmon, sea trout and freshwater trout are the main finfish species farmed, though eels, turbot and halibut are starting to appear: Inter Eascann, an eel farm in Arklow, Co. Wicklow, opened in 1995, and a number of turbot farms have been established along the south-west coast.

Bottom- and rope-cultured mussels, pacific and native oysters and clams are the main shellfish species harvested. Shellfish cultivation is less intensive than finfish farming and does not entail the same level of intervention in terms of either feeding or use of drugs. Scallops and abalone are among the newer varieties being introduced.

The seaweed industry

The seaweed industry is concentrated along the west coast, particularly in Gaeltacht areas. Total output was £3 million in 1994 from a sector that employs 320 people on a seasonal basis, a further 120 full-time in harvesting, and 50 more, some of them part-time, in processing.

Arramara Teoranta, whose majority shareholder is the Department of the Marine, consumes about 90 per cent of the total harvest each year, most of it exported to Scotland. A number of new companies are emerging, however, offering high-value niche products like cosmetics, health foods and horticultural products, all based on seaweed.

The Irish Seaweed Industry Organization (ISIO), based at the Martin Ryan Marine Science Institute at UCG, acts as a link between the industry and researchers. Thirteen companies are now affiliated, including a family-run firm in Belmullet, Feamainn Cairn, which offers "thalassotherapy" and aromatherapy using seaweed-based oils, and the intriguing prospect of a seaweed jacuzzi! For a fuller account of the Irish seaweed industry, see the ISIO Web site at: <http://www.seaweed.ucg.ie>.

Fish-processing sector

Fish-processing is concentrated around the main fishing ports, with counties Donegal, Galway, Kerry, Cork, Wexford and Dublin the principal centres. The activity is widely spread among a large number of small firms: about 220 companies employ 3,400 people.

Developing the fish-processing sector falls within Forbairt's brief and the agency would like to see more value added to the raw material. Currently the pelagic (mackerel and herring) catch accounts for most of the processing activity, with low-value, commodity-type products such as frozen whole fish and fillets accounting for most of the output. (As the fresh market consumes a large portion of the demersal catch at a relatively high price, the opportunity for adding value to this part of the chain is minimal.)

Forbairt has identified prepared seafood products, such as breaded and coated whitefish, fish in sauce and other convenience products, as the optimum way to maximize value. The other main area is processed products, like vacuum packed, jarred and canned fish.

Forbairt, which wats to see two or three large-scale operators emerge in each area by the end of the decade, is encouraging mergers and joint ventures among Irish firms and between Irish and overseas investors; promoting co-operative marketing initiatives among Irish firms; and encouraging new and existing players to move into value-added production. (Source: *Technology Ireland*, May 1996)

Malta

Marsaxlokk freeport terminal 2

Posford Duvivier has worked closely with the Malta Freeport Corporation on the planning and design of the state-of-the-art containers terminal for which construction was commenced in 1995. The new container terminal will provide the Freeport with a further 500,000 TEU capacity which is required to cater for the continuing dramatic increase in cargo throughput.

The new container terminal includes over 1,500 m of new quay which will be formed with sixty-five 22.68 m diameter cellular coffer-dams up to 27 m high, some of the largest ever constructed. Posford Duvivier has designed to reinforced concrete cope structure to complement the substructure arrangement, with independent support provided by 400 ton capacity bored cast-in-place piles. The cope structure is designed to maximize the potential for precast concrete works for ease of construction and to facilitate good quality control.

The Terminal 2 development represents a US$205 million investment by Malta Freeport Corporation. The capital was raised on International Capital Market Funds and Global Registered Notes.

A £7 million subcontract was awarded by NOVITA to Costain Marine International for the construction of 65 cellular coffer-dams which comprise the principal element of the piling works. The coffer-dams are being fabricated on land and then lifted, transported and pitched by a 1,000 ton capacity sheerleg barge. Piling work was started on site last August for completion at the end of this year.

Dredging was recently completed by Boskalis of the Netherlands and Dragomar of Italy. This involved enlargement and deepening of the shipping basis between Terminal 1 and Terminal 2, together with the excavation of a deep trench (approximately 1.5 km long) for the concrete wall of the new quay wall.

The whole project is scheduled for completion in November 1998. (Source: *The Dock & Harbour Authority*, February/March 1996)

Netherlands

Remotely controlled screening, recovery of seabed soils

Boskalis Offshore BV (Papendrecht, Netherlands) has developed NAMROD, a system for the screening and bulk sampling of seabed materials to depths of 120 metres. NAMROD can dredge and sample a 40 m^3 volume of basal sediment.

The self-contained workstation carries two booms—with which it gathers the sediments—and a built-in screening plant. Remotely operated from the surface, the system is designed to enable the offshore engineer to work relatively unhindered by adverse weather or deep waters. Fitted with the latest generation of high-resolution inspection devices, NAMROD enables the engineer to view and accurately measure seabed excavations—no matter how deep or dark the waters—from the comfort of an on-board control station. It can be used to selectively dredge areas around platforms for polluted muds or drill cuttings or to clean the bedrock prior to seabed installations.

The system is configured to screen materials of a particular size, depending upon the application. Materials not required are returned to the seabed, while the subject matter is pumped to the surface for further evaluation. (Source: *Sea Technology*, March 1996)

Maritime Information Centre

The Maritime Information Centre/Delft University of Technology Library (MIC/DUTL) provides answers to nautical, technical and economic questions in the area of shipping, shipbuilding, fishery, ports and the offshore industry.

The object of the Maritime Information Centre, which is a division of the Delft University of Technology Library, is to make industrial and scientific maritime information and documentation accessible to trade and industry, educational institutions, the Government and private individuals.

Collection

The collection of the Maritime Information Centre comprises, *inter alia*, literature dealing with the following subjects: the ship (ship descriptions and design aspects), shipping and navigation, shipbuilding, ports and waterways, fishery (trade, industry and fishing methods), the offshore industry (oil and gas production), deep-sea mining, inland navigation, water pollution (causes and control), energy-related problems, diving, the navy (ship descriptions and military aspects), sailing vessels and yachts, ice (ice formations and ice breaking), laws, rules and regulations.

For further information contact the Maritime Information Centre, P.O. Box 98, 2600 MG Delft, The Netherlands; (Fax: +31(0) 15 278 68 55; E-mail: mic@library.tudelft.nl)

Portugal

Madeira Island. Funchal airport extension

As part of a consortium including Consulgal, Prima and O'Brien Kreitzberg, Mott MacDonald was appointed by ANAM, the Madeira Airport Authority, to provide consultancy services for the extension of Funchal Airport.

The extended runway will be located over the sea and elevated on columns to maintain runway level. In order to construct this extension the sea area beneath will first be reclaimed and the reclamation will be bordered by an armour stone structure to protect it from the heavy swells and storms approaching from the Atlantic Ocean.

The protection structure is likely to be of the berm breakwater type which will allow locally obtained armour stone to be used. Physical modelling testing of the proposed berm breakwater structure has been undertaken in the laboratories of Delft Hydraulics in the Netherlands using 2-D and 3-D test procedures to develop the profile. (Source: *The Dock & Harbour Authority*, April 1996)

Russia

Port of Nakhodka

Nakhodka is located at the Pacific terminus of the Trans-Siberian Railway and is one of the three largest ports in the south of the Russian Far East. It is situated in the Bay of Nakhodka which enjoys year-round navigation, although the construction season is limited to about seven months a year due to low temperatures.

The marine commercial seaport has a total of 22 berths. These service Russia's export and import trade with Japan, Korea, China and Thailand, as well as coastal movements to the ports of the far north.

In the 1980s the ability to handle steadily increasing traffic began to be constrained by the limited onshore open storage area. In 1990 the port embarked on a plan to build 1,000 m of new quay wall, 60 m seaward of berths 2-10, and infill behind the wall to create the required new open storage area.

Scott Wilson Kirkpatrick was invited to analyse the port's requirements and recommend a course of action. It was recommended, and the port accepted, to invite design-and-construct bids from selected international contractors.

To date, the project has resulted in a useful interchange of technical information with both Russian and Western participants in the project benefiting from new viewpoints. (Source: *The Dock & Harbour Authority*, February/March 1996)

Port of Tuapse

Mouchel was commissioned by Bovis International Ltd. to review and update the business plan for Russia's second largest port on the Black Sea, owned and operated by a ship repair company.

Particular aspects considered were the need to replace the breakwater which enclosed the port; the provision of facilities to increase the capacity of oil and coal exports; and environmental impact and development costs. A financial assessment was made of the various options to determine the internal rate of return and pay-back period. (Source: *The Dock & Harbour Authority*, February/March 1996)

Port of Novorossisk

Scott Wilson Kirkpatrick is providing technical assistance to, and capability building of, port management of Novorossisk Commercial Seaport, Russia.

The project includes 800 m of new quay wall comprising steel sheet piling combined with a reinforced concrete relieving slab supported on bearing piles. The quay is designed to support travelling cranes, railway wagons, grain unloaders and mobile cranes. The landside works include the raising and reclamation of a 30 ha terminal area. Heavy duty port paving has been designed together with surface and foul water drainage systems, railway tracks, M&E services and communications systems.

An environmental impact assessment (EIA) for the port rehabilitation works was carried out by Posford Duvivier in accordance with EBRD's environmental procedures. The EIA identified the existing environmental quality, the natural resources (e.g. fisheries) and their significance for the Caspian Sea, other land uses, the current environmental legislation requirements, and the port's environmental management practices and future needs.

The potential impacts from the construction and operational phases of the port development activities on the natural and human environment, and other sea/land users (e.g. power station intake channel) were assessed. Mitigation measures for the identified impacts, and environmental quality protection and improvement measures for both the construction contractor and port authority were recommended. The port's future environmental management needs were identified (e.g. waste reception facilities for visiting ships) and recommendations put forward. (Source: *The Dock & Harbour Authority*, February/March 1996)

United Kingdom

PFEER rules may allow use of composites offshore

The 1995 Prevention of Fire and Explosion and Emergency Response (PFEER) regulations have important implications for the use of composites in UK offshore installations.

Broadly speaking, they remove the need to comply with certain old prescriptive requirements, irrespective of whether these are efficient means of managing hazards. Instead, general duties are imposed, the aim being to promote a risk-based, systematic approach to managing fire explosion hazards and emergency response.

The new regulations will supersede SI289, legislation in force since 1974, which covers construction and survey

of offshore installations. Among other stipulations, this had required that all parts of an installation be composed of material that was incombustible, so far as this was consistent with its function. That latter phrase seemed to virtually rule out use of composites.

However, the new goal-setting regulations obviate the need for incombustibility *per se*. Instead, operators themselves must decide on the suitability of the materials they choose. This means that greater use of composite materials could be permitted, based on assessment of their risk in relation to the integrity of the installation and fire and explosion hazards. Possible applications include firewater pipework, fire and blast walls, storage tanks, decking and stairs.

The advantages of composites over steel are light weight, resistance to corrosion and lower thermal conductivity (important if they are used as part of a fire-resisting structure). Disadvantages include combustibility and the requirement for a much higher standard of quality control in manufacture and fabrication and installation than for steel, if composites are to be reliable in operation.

Although the greater flexibility of the new regime will likely permit use of composites where they have not hitherto been used, it will also impose conditions. It is uncertain at this stage how HSE's new consultative document on proposed design and construction regulations (DCR) will affect use of composite structures. It appears, however, that the only likely constraints will be the need to ensure the integrity of the installation and for materials to be proof against anything that could prejudice that integrity.

Safety requirements now in force

The Offshore Installations (Prevention of Fire and Explosion and Emergency Response) regulations and the Offshore Installations and Pipeline Works (Management and Administration) regulations both came into force in the UK last year. Key requirements for offshore operators are to:

- Protect persons on the installation from fires and explosions;
- Assess major accident hazards arising from fires and explosions and set performance standards for measures to protect persons from such accidents;
- Take appropriate measures to prevent, control and mitigate fires and explosions and detect fires or events that could lead to a fire or explosion.

(Source: *Offshore*, February 1996)

Nine-month fishery monitoring and surveillance trial

A nine-month fishery monitoring and surveillance trial in the UK has shown that satellite tracking can not only reveal a vessel's position but can also detect whether the vessel is actually fishing in a prohibited area.

Twenty vessels took part in the voluntary trial, which was organized by the UK's Ministry of Agriculture and Fisheries and Food (MAFF) as part of a wider European Commission initiative to determine whether compulsory fishing vessel monitoring would be desirable and practical for the whole European Union fleet.

The system used in the trial was developed by technology consultant Smith System Engineering Ltd. Each vessel was fitted with a satellite position monitoring terminal that transmitted position reports automatically at regular intervals. The reports were sent via a communications satellite to two central tracking and monitoring stations, one at MAFF in London and one at the Scottish Fishery Protection Agency in Edinburgh.

The tracking system requires no action by the crew and, in this respect, is simpler than enforcement systems in common use on land, such as tachographs in trucks.

Moreover, the trial proved that it is possible not only to detect the vessel's position with great accuracy but also, by analysing track patterns, to determine whether the boat is actually fishing and even the type of fishing method being employed. This highlights its usefulness as a tool for the management of fishing effort and as an aid for fish stock conservation in the future. (Source: *Ocean Voice*, April 1996)

UK coastal planning policy

Planning procedures and influences along the 6,700 miles of UK coastline have been reviewed by Rendel Geotechnics to help the Department of Environment to develop a cohesive planning policy. Both parts of the review have now been published.

The study, which began in September 1991, established the range of geographical and geotechnical data needed to improve decision-making in the coastal zone and to reduce conflicts between agencies and interested parties.

Five case studies were carried out in contrasting coastal environments facing different development pressures. These were salt marsh, estuary, sand dunes and soft rock and hard rock cliffs.

The principal aim of the study was to provide the Department of Environment with a framework on which to base planning policy guidelines for local authorities and other interested parties on development in coastal zones, and advice on Earth science information required for decision-making. (Source: *The Dock & Harbour Authority*, May 1996)

Cliff erosion study

Rendel Geotechnics, in association with HR Wallingford, is working on a £280,000 contract to develop methods of prediction and recording coastal cliff erosion rates that can be used by local authorities and coastal engineers.

The three year project for the Ministry of Agriculture, Fisheries and Food (MAFF) will also evaluate a range of methods for reducing and controlling erosion.

The project is aimed at helping coastal engineers to accurately predict future rates of erosion and to select suitable techniques to control erosion. The methods that are to be developed will improve the way in which coastal protection schemes are evaluated on economic and environmental grounds.

In the past, engineers have largely determined cliff recession rates from historical data. Cliff erosion has often been halted rather than controlled, frequently by building massive "hard engineering" structures.

Now MAFF wants to investigate more accurate and reliable prediction methods and erosion control techniques which include "soft engineering" methods that work with, rather than resist, natural coastal processes. (Source: *The Dock & Harbour Authority*, May 1996)

Record numbers of UK development wells documented

A record 244 new development wells were drilled in the UK North Sea last year and a record 324 offshore wells were spud during 1995, according to the UK Department of Trade and Industry's 1996 *Brown Book*. Investment in the sector rose by 19 per cent to $6.3 billion, representing 18 per cent of total UK industrial investment, and is forecast to stay at this level over the next few years. Total oil production reached its highest level yet at 130 million tons, up from 127 million tons in 1994, according to the *Brown Book*. Gas production also is at its highest level yet at 75 billion cubic metres, up from 70 billion cubic metres in 1994. The annual report also noted that more oil and gas fields are in production than ever—up to 163 fields at the end of 1995, an increase of 14 fields from the prior year's report. (Source: *Sea Technology*, June 1996)

UK Government issues ferry upgrade schedule

The United Kingdom Department of Transport has issued a list of deadlines detailing when every roll on/roll off (ro-ro) passenger ferry currently operating out of a British port, or expected to in the near future, will have to meet the survivability standards adopted in the recent Stockholm Agreement, which comes into force on 1 April 1997.

This requires that all ro-ro passenger ferries operating on international journeys to and from ports in the Baltic and north-western Europe must meet both the SOLAS 90 survivability standard plus an ability to cope with up to 50 cm of water entering the car deck.

The timetable for compliance is based on a formula designed to require that those ferries that are furthest from the standard are modified sooner than those already close to it. All vessels will be required to reach the standard by 1 October 2002.

Four must be modified no later than their first annual survey after 1 April 1997, five no later than the first survey after 31 December 1998, 21 no later than the first survey after 31 December 1999, 11 no later than the first survey after 31 December 2000, and 59 no later than the first survey after 31 December 2001 and before October 1 2002. (Source: *Fast Ferry International*, July/August 1996)

Caspian region

Caspian equal to Mid-east Gulf

Word is quietly coming out of the Caspian region that long-neglected inland sea may very well be harboring vast reservoirs of hydrocarbons that could equal if not surpass those of the Arabian/Persian Gulf. Newly acquired 2-D and 3-D seismic data in Azerbaijani and Kazakh waters reveal numerous probable oil-bearing structures, and studies of Turkmenistan's and Iran's Caspian aquatory show similar stratigraphic features. As a consequence, there has been a surge of interest in Caspian concessions—either leasing or farming into them—and Russia, which ignored the Caspian for decades, has now rediscovered its cultural and strategic links to the lands along its shores and, in particular, to the resources beneath its waters.

Azerbaijan

Azerbaijan, with at least 15 billion bbl in probable reserves beneath the Caspian was the first to draw attention to its aquatory, and it continues to lead the littoral list in attracting suitors.

Kazakstan

Across the Caspian from Azerbaijan and occupying most of its eastern shores is Kazakstan, a late-comer to exploiting its subsea hydrocarbons, but the probable possessor of more than 27 billion bbl of oil and untold gas reserves within its aquatory.

Interpretation of the seismic is revealing that lying just offshore the Tenghiz area, is a likely oil giant, an 8-10 billion bbl structure that is probably the most promising of the many revealed so far. Farther out, the 103,000 km^2 Kazak aquatory appears to contain a series of highly prospective structures that could also prove to be major fields. Further interpretation is needed, but it supports the prediction, at least from Kazak waters, that the Caspian may well be the Persian Gulf of the twenty-first century.

Turkmenistan

Unlike its Caspian neighbours, Turkmenistan, sorely in need of petroleum production, has had a hard time attracting explorers and developers, even though it is offering both joint ventures and production sharing contracts for its five Apsheron Sill blocks, which contain seven fields in various states of operability, and for the entire Turkmen aquatory north of the Sill. (Source: *Offshore*, March 1996)

G. INTERNATIONAL NEWS

FAL Convention is amended

The International Maritime Organization (IMO) Facilitation Committee adopted a number of amendments to the Convention on Facilitation of International Maritime Traffic, 1965. They are expected to enter into force under the Convention's "tacit acceptance" provisions on 1 May 1997.

The amendments affect standards and recommended practices contained in the annex and deal with the following subjects: the Passenger List; the establishment of national maritime transport facilitation committees; the development of procedures, including electronic data interchange (EDI), to allow for the submission of advance information to enable the use of selectivity techniques to facilitate customs clearance; and the declaration of the personal effects of cruise passengers.

New standards have been added concerning inadmissible persons; the obligations of shipowners to transport persons; and cooperation between Governments and shipowners to establish the validity of passports and visas. A new recommended practice has been added on immigration pre-arrival clearance.

Guidelines on stowaways

The Committee approved a draft FAL circular on the allocation of responsibilities to seek the successful resolution of stowaway cases. It is expected that a draft Assembly resolution on the same subject will be finalized at the next session in 1997 and adopted by the twentieth IMO Assembly later in the same year.

An international convention relating to stowaways was adopted in Brussels in 1957, but it has not yet entered into force and is now unlikely to do so. In recent years, however, the problem of stowaways has increased and it is generally recognized that there is an urgent need for international agreement on the allocation of responsibilities to enable the successful resolution of cases involving stowaways.

Stowaways entering a country without the required documents are, in general, illegal immigrants, and decisions on how to deal with such situations are the prerogative of the countries concerned. Stowaway asylum seekers should be treated in compliance with international protection principles set out in relevant treaties.

The guidelines then advocate close cooperation between shipowners and port authorities.

The guidelines say that every effort should be made to avoid situations where a stowaway has to be detained on board a ship indefinitely.

The draft Assembly resolution refers to the difficulties encountered by masters and owners in disembarking stowaways from ships. It emphasizes the need for cooperation and states that in "normal circumstances, through such cooperation stowaways should, as soon as practicable, be removed from the ship and returned to the country of nationality/citizenship or to the port of embarkation, or to any country which would accept the stowaway". (Source: *IMO News No. 4/95 & No. 1/96* (joint issue))

Bulk carrier safety causes fresh concern

A.797 (19): Safety of ships carrying solid bulk cargoes

Despite action taken by IMO and other organizations in recent years, there is still considerable concern about the safety of bulk carriers, and this is reflected in the resolution. It notes that interim measures to improve safety were adopted by the last Assembly and the work undertaken by Governments, classification societies and other segments of the private sector.

The Maritime Safety Committee (MSC) has initiated further measures to enhance the safety of ships carrying solid bulk cargoes and is in the process of defining the problems and suggesting solutions, both in the short term and in the long term. It is also considering all relevant aspects of risks to ships carrying solid bulk cargoes as a ship type, so that all elements of safety are assessed in their totality, and has carried out a review of recent losses involving ships carrying solid bulk cargoes with special reference as to whether they had been subjected to enhanced surveys.

The resolution goes on to note the work done by the International Association of Classification Societies (IACS) in developing survey and maintenance requirements for ships carrying solid bulk cargoes.

It urges Governments, classification societies, shipowners, ship operators, shipmasters and terminal operators, pending the development of these requirements, to take immediate measures along the lines specified in an annex.

The MSC is requested to carry out, with high priority, its work on the safety of ships carrying solid bulk cargoes and to develop, as soon as possible, requirements and recommendations covering survivability standards, design and construction standards, operational standards, survey requirements, ship/shore interface aspects and management and training.

Governments are invited to thoroughly investigate accidents occurring to ships carrying solid bulk cargoes entitled to fly their flag and to submit to the Organization the conclusions arrived at and any recommendations made. Governments in whose territories solid bulk cargo loading and unloading terminals are situated are asked to advise IMO of any studies on cargo-handling practices at such terminals for information purposes and to take appropriate measures for educating all concerned on the avoidance of inadvertent overloading. (Source: *IMO News No. 4/95 & No. 1/96* (joint issue))

Corrosion measures to aid bulk carrier safety

A.798(19): Guidelines for the selection, application and maintenance of corrosion-prevention systems of dedicated sea water ballast tanks

The resolution is concerned with the safety of bulk carriers and oil tankers and refers to earlier resolutions adopted on this subject, including A.713 (17), which specified interim measures to be taken to improve the safety of ships carrying solid bulk cargoes.

It also refers to resolution A.744 (18) on guidelines on the enhanced programme of inspections during surveys of bulk carriers and oil tankers, by which it specified detailed inspection requirements to improve safety and marine pollution.

Among other items, it stipulates interdependence of the condition of coating and survey requirements and the importance of correctly applied and maintained corrosion-prevention systems in dedicated sea-water ballast tanks, which are more susceptible to corrosion, in improving the safety of the ship.

The resolution recognizes that the MSC, at its sixty-third session, approved draft amendments to the International Convention for the Safety of Life at Sea (SOLAS), 1974 by adding a new regulation II-1/14-1 requiring corrosion prevention systems to be fitted in dedicated sea water ballast tanks of new bulk carriers and oil tankers, referring to the guidelines developed by the Organization, for inclusion in the set of amendments proposed to enter into force in 1998. (Source: *IMO News No. 4/95 & No. 1/96*)

Hazaradous and Noxious Substances Convention adopted by IMO Conference

An international convention on liability and compensation for damage in connection with the carriage of hazardous and noxious substances (HNS) by sea was adopted at the end of a three-week conference held at the London headquarters of the International Maritime Organization in April 1996.

It will make it possible for the equivalent of up to £250 million to be paid out in compensation to victims of accidents involving HNS, such as chemicals.

Although IMO is best known for its work in connection with maritime safety and the prevention of pollution from ships, the *Torrey Canyon* oil pollution disaster of 1967 made the international maritime community realize that there was no international system for providing adequate compensation in connection with major spills of oil and other substances.

IMO was given the responsibility of adopting a series of international treaties dealing with liability and compensation issues. The International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969 and the International Conventional on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND), 1971 established a two-tier system under which compensation up to a fixed limit is paid by the shipowner. Once that limit is reached, additional compensation is paid from a Fund made up of contributions from oil importers. The HNS Convention is based on this system. However, it goes further in that it covers not only pollution but also the risks of fire and explosion.

The HNS Convention defines its scope of application by reference to existing lists of substances, such as the International Maritime Dangerous Goods (IMDG) Code and Annex II of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78).

The Convention introduces strict liability for the shipowner, higher limits of liability than the present general limitation regimes and a system of compulsory insurance and insurance certificates.

It has generally been agreed that it would not be possible to provide sufficient cover by the shipowner's liability alone for the damage that could be caused in connection with the carriage of HNS cargo. This liability, which creates a first tier of the Convention, is therefore supplemented by a second tier, the HNS Fund, financed by cargo interests.

In principle, compensation will be paid from the HNS Fund when the shipowner's liability is insufficient to provide full compensation or when no liability arises under the first tier. Contributions to the second tier will be levied on persons in the Contracting Parties who receive a certain minimum quantity of HNS cargo during a calendar year. The tier will consist of one general account and three separate accounts for oil, liquefied natural gas (LNG) and liquefied petroleum gas (LPG). The system with separate accounts has been seen as a way to avoid cross-subsidization between different HNS substances. (Extracted from *IMO Briefing No. 4/96*)

1989 salvage convention to enter into force

The International Convention on Salvage, which was adopted in April 1989 at a conference convened by the International Maritime Organization entered into force on 14 July 1996. It will replace a convention on the law of salvage adopted in Brussels in 1910.

The 1910 Convention incorporates the "no cure, no pay" principle under which a salvor is only rewarded for his services if the operation is successful. Although this basic philosophy has worked well in most cases, it does not take pollution into account. A salvor who prevents a major pollution incident (for example, by towing a damaged tanker away from an environmentally sensitive area) but does not manage to save the ship or the cargo gets nothing. There is therefore little incentive to a salvor to undertake an operation which has only a slim chance of success.

The new Convention seeks to remedy this deficiency by making provision for an enhanced salvage award, taking into account the skill and efforts of the salvors in preventing or minimizing damage to the environment. It further introduces a "special compensation" to be paid to salvors who have failed to earn a reward in the normal way (i.e. by salving the ship and cargo).

Damage to the environment is defined as "substantial physical damage to human health or to marine life or resources in coastal or inland waters or areas adjacent thereto, caused by pollution, contamination, fire, explosion or similar major incidents".

The compensation will consist of the salvor's expenses, plus up to 30 per cent of these expenses if, thanks to the efforts of the salvor, environmental damage has been minimized or prevented. The salvor's expenses are defined as "out-of-pocket expenses reasonably incurred by the salvor in the salvage operation and a fair rate for equipment and personnel actually and reasonably used". The tribunal or arbitrator assessing the reward may increase the amount of compensation to a maximum of 100 per cent of the salvor's expenses, "if it deems it fair and just to do so".

If, on the other hand, the salvor is negligent and has consequently failed to prevent or minimize environmental damage, special compensation may be denied or reduced. Payment of the reward is to be made by the vessel and other property interests in proportion to their respective salved values. (Source: *IMO Briefing No. 5/96*)

Inmarsat confirms global distress and safety commitment

Assembly meeting quells concern over organization's future structure

Uncertainty in the maritime community about the future commitment of Inmarsat to distress and safety communication has been dispelled following a key meeting of the organization's governing Assembly in London in March 1996.

The Assembly met to discuss options for the future structure of Inmarsat in the light of increasing commercial pressure on its satellite communication services.

While recognizing that changes were urgently required for Inmarsat to remain effective in the long term, the Assembly agreed on a list of five principles and obligations that any restructured Inmarsat would have to abide by.

Foremost among them was the continued provision of global maritime distress and safety services and support of the Global Maritime Distress and Safety System (GMDSS).

The news has been warmly received within the maritime industry.

Other principles that the Assembly confirmed will be enshrined in any "new-look" Inmarsat to include no discrimination on the basis of nationality, the use of the Inmarsat system solely for peaceful purposes and in all areas where there is a need for mobile satellite communication, together with a commitment to fair competition.

The next step on the road to restructuring Inmarsat will be a Council meeting to consider specific structural models that incorporate the Assembly's basic principles.

The Assembly will convene again late in 1996 or early in 1997 for final approval of the future structure and the timetable for its implementation. (Source: *Ocean Voice*, April 1996)

The 1992 Protocols to the Civil Liability Convention and the Fund Convention

A diplomatic conference held in November 1992 under the auspices of IMO adopted two Protocols to amend the 1969 Civil Liability Convention and the 1971 Fund Convention. These Protocols provide higher limits of compensation and a wider scope of application than the Conventions in their original versions. They contain the same substantive provisions as two Protocols adopted in 1984, but with lower entry into force provisions, since it had become clear that the 1984 Protocols would not obtain the required number of ratifications to enter into force.

The Protocols of 1992 amending the Civil Liability Convention and the Fund Convention entered into force on 30 May 1996. As at 31 December 1995, 15 States had deposited instruments of ratification, acceptance, approval or accession relating to both of the 1992 Protocols, and one State had deposited an instrument of accession only to the 1992 Protocol to the Civil Liability Convention.

Main amendments

The main differences between the Civil Liability Convention and the Fund Convention in their original version and the Conventions as amended by the 1992 Protocols are the following:

- **Special liability limit for owners of small vessels and substantial increase of the limitation amounts.** The revised limits will be: (a) for a ship not exceeding 5,000 units of gross tonnage, 3 million Special Drawing Rights (SDR) (£2.9 million); (b) for a ship with a tonnage between 5,000 and 140,000 units of tonnage, 3 million SDR (£2.9 million) plus 420 SDR (£403) for each additional unit of tonnage; and (c) for a ship of 140,000 units of tonnage or over, 59.7 million SDR (£57.3 million).
- **Increase in the limit of compensation payable by the International Oill Pollution Compensation (IOPC) Fund** to 135 million SDR (£130 million), including the compensation payable by the shipowner under the 1992 Protocol to the Civil Liability Convention. This limitation figure would be increased automatically to 200 million SDR (£192 million) if there were three Member States of the 1992 Fund (i.e. the Organization which will be established under the 1992 Protocol to the Fund Convention) whose combined quantity of contributing oil received during a given year in their respective territories exceeded 600 million tons.
- A simplified procedure for **increasing the limitation amounts** in the two Conventions.
- **Extended geographical scope** of application of the Conventions to include the exclusive economic zone (EEZ), established under the United Nations Convention on the Law of the Sea.
- Pollution damage caused by spills of persistent oil from **unladen tankers** will be covered.
- Expenses incurred for preventive measures are recoverable even when **no spill of oil** occurs, provided that there was **a grave and imminent danger** of pollution damage.
- **New definition of pollution damage** retaining the basic wording of the present definition with the addition of a phrase to clarify that, for environmental damage, only costs incurred for reasonable measures to restore the contaminated environment are included in the concept of pollution damage. (Extracted from *International Oil Pollution Compensation Fund Annual Report 1995*)

Earth Summit—Agreement on High Seas Fishing

Introduction

On 4 August 1995, agreement was reached at the United Nations on ways to prevent conflict over fishing on the high seas, and to conserve stocks of fish which migrate between international waters and areas under national jurisdiction.

Under the new legally-binding Agreement, States will no longer have the freedom to fish on the high seas as they did under the traditional law of the sea. Instead, Governments will be obliged to cooperate and regulate fishing in order to prevent the depletion of species and to preserve stocks for the future.

Negotiations for a high seas fishing agreement were called for at the UN Conference on Environment and Development—the Earth Summit, held in Rio de Janeiro, Brazil, in June 1992—by Governments seeking to address an issue left unresolved in the 1982 United Nations Convention on the Law of the Sea (UNCLOS).

The formal title of the new accord is the United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.

Under the Law of the Sea, coastal States gained control of the seas up to 200 miles off shore—known as exclusive economic zones (EEZs)—and the marine

resources found there. Fishing on the high seas, which were viewed as "global commons", remained unregulated.

While some species of fish remain in coastal waters, many—such as cod off the east coast of Canada and pollack in the Bering Sea—straddle the boundaries of the 200 mile zones. Others, like tuna and swordfish, migrate over wide areas of the high seas. The 1982 Convention made provision for the conservation of certain migratory species, such as salmon and eel, but did not cover most other species.

The problem

According to the Food and Agriculture Organization of the United Nations (FAO), 70 per cent of fish stocks are currently either fully exploited, overfished or in the process of recovering from overfishing. Between 1970 and 1990, the global fishing fleet grew at twice the rate of the marine catch, supported by Government subsidies of some US$ 54 billion annually.

As catches on the high seas grew smaller, fleets developed more sophisticated equipment and began to fish further away from home. Coastal States protested that increased catches on the high seas reduced the amount of fish available in territorial waters. Several countries banned or set quotas on domestic fishing. Meanwhile, unregulated fleets from "distant-water" fishing States continued to fish just outside the 200 mile boundaries.

The coastal States most concerned with the impact of high-seas fishing on the domestic harvest include Canada, Argentina, Australia and New Zealand. Six countries are responsible for 90 per cent of high-seas fishing: Russia, Japan, Spain, Poland, the Republic of Korea, and Taiwan, province of China. The United States also does a significant amount of high-seas fishing, especially for tuna, and in recent years China has become a major fishing nation.

As negotiations on a fishing agreement progressed, reports of skirmishes between national fishing fleets in international waters became increasingly frequent. Some turned violent and on several occasions Governments called out navy vessels to protect their fishing fleets.

The Agreement

The new Agreement seeks to ensure the long-term conservation and sustainable use of straddling and highly migratory fish stocks. It responds to problems identified in Agenda 21, the Rio Programme of Action, such as the inadequate management of high-seas fisheries, the over-utilization of stocks, unregulated fishing and unreliable data. It also addresses concerns about excessive fleet size ("too many boats chasing too few fish"), the over-capitalization of boats, which exerts pressure to bring in large catches to pay for expensive equipment, and the use of insufficiently selective fishing gear resulting in large quantities of commercially undesirable fish ("by-catch") being thrown back dead into the ocean.

The Agreement calls on States to ensure compatibility between regimes for conserving and managing stocks of straddling and highly migratory fish in areas under national jurisdiction and in adjacent areas of the high seas, and to exercise a "precautionary approach" in allocating quotas, especially where information on fisheries stocks is inadequate.

The provisions of the new Agreement apply to the fishing fleets of all States, whether or not a country is party to the Agreement. While international law provides that a country which does not ratify an international legal agreement cannot be bound by its provisions, the new Agreement gives regional fishing organizations responsibility for regulating—and enforcing—sustainable fishing practices in areas under their jurisdiction. Any country which is a member of the regional organization can enforce the provisions of the Agreement against any State wishing to fish in those areas.

Regional fishing organizations will also agree on standards for collecting, reporting, verifying and exchanging data, review the status of stocks, agree on the amount of fish to be caught in the region and allocate States' quotas for high-seas fishing.

Most maritime law is enforced by the "flag State", where a ship is registered. The Agreement addresses situations where ships fishing on the high seas are too distant from their flag State to be adequately supervised or where the flag State is unwilling or unable to police its vessels. It gives any country that is a member of a regional fishing organization the right to board and inspect the vessels of other States fishing in the area in order to ensure that regional conservation measures are being followed.

If there are reasonable grounds for believing that a fishing boat is violating conservation rules, the inspecting State will notify the flag State. If the flag State does not respond within three working days—during which time the inspectors may stay on board—the inspecting State can detain the vessel in port for future action. If the flag State feels that enforcement measures have been taken without its consent, it can begin dispute settlement procedures outlined in the Agreement.

Background

Negotiations on the Agreement were conducted by the United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks, which was set up by the General Assembly following the Earth Summit. The Conference began work in July 1993 and held six sessions before adopting the Agreement in August 1995. The Chairman of the Conference was Ambassador Satya N. Nandan of Fiji.

The Agreement will be opened for signing at a ceremony in New York on 4 December 1995. It will enter into force after ratification by 30 countries, a process which could take two years. In the meantime, many countries are expected to implement the Agreement provisionally, especially the measures relating to conservation and management. Four years after entry into force, a conference will be held to review the effectiveness of the Agreement and to propose any additional measures necessary to strengthen it.

For more information contact: Department of Public Information, Information Programme on Sustainable Development, Room S-1040, United Nations, New York, NY 10017, USA (Fax: (212) 963-1186).

Coral reef workshops

The fifth of six regional workshops taking place around the world under the International Coral Reef Initiative (ICRI) was held in Mahe, Seychelles, in April 1996, resulting in the development of an Action Plan for coral reef management in the region of the Western Indian Ocean and East Africa.

Participants addressed community participation, sustainable financial mechanisms, regional priorities and strategies, as well as the institutional aspects of coral reef and related ecosystem management. The last workshop to be convened later this year will focus on the Red Sea.

UNEP is facilitating the convening of the workshops through its Regional Seas Programme, is providing technical assistance to regions, and is seeking donor support

for implementation of the priority actions identified through the workshops. (Source: *Our Planet*, Vol. 8 No. 2)

European Union ratifies OECD Agreement on Shipbuilding

The European Union ratified the OECD Agreement on Shipbuilding at a meeting of the OECD Council Working Party on Shipbuilding held in December 1995.

Korea and Norway also ratified the Agreement at the same meeting. However, the United Sates and Japan, despite having committed themselves to ratifying the agreement by the end of 1995, failed to do so, but gave assurances that they would deposit their instruments of ratification as soon as possible, and by 15 June at the latest. The Agreement will not enter into force before all signatories have ratified it.

The aim of the Agreement, outlined in a statement from the European Commission, is to create a single framework for controlling subsidies, enforcing fair competition and preventing unfair trading practices on a world level.

It will help improve EU shipyards' access to export markets and reduce the likelihood of unfair dumping on the market of the members of the Agreement, increasing confidence between major shipbuilding nations and improving the climate for growth in the industry. From the EU's point of view, it will introduce strict controls to ensure fair trading by Europe's biggest competitors, namely Japan and Korea, which together account for over half the world's production of ships.

Under the Agreement, all parties will eliminate, at its entry into force, direct and indirect subsidies granted specifically to the shipbuilding industry.

The package creates a special instrument designed to curb unfair "dumping" and to make it harder to evade payment of dumping penalties. The "Injurious Pricing Instrument" will be specific to the shipbuilding sector. It will operate on the basis that the shipbuilder, rather than the importer, is responsible for the penalty as the yard is far more easily identifiable.

In cases where the shipbuilder refuses to pay such a penalty, the country of the buyer can impose counter-measures, notably by banning all vessels produced by the offending shipyard from loading or discharging in its ports.

Turning to export credits, the Agreement aims to create a more level playing field for access to government-sponsored export credit insurance and other export guarantees.

The Agreement revises the OECD's Understanding on Export Credit for Ships, maintaining the non-binding nature of the way disputes are settled, while the concept of pure cover (*garantie pure*) will be authorized for the first time. This means that a potential exporter can receive a full advance guarantee from the State or State-sponsored export credit agency against the risk of the purchaser failing to pay for a ship once it has been built. Furthermore, such a guarantee may last for a reimbursement period of 12 years, instead of 8.5 as at present. (Source: *Fast Ferry International*, March 1996)

Combined meeting of International Association of Port and Harbour Authorities (IAPH) Committees

A summary report on the combined meeting of IAPH committees on port safety and environment and marine operations held on 28 and 29 March 1996 in Rotterdam, the Netherlands was prepared. The more significant issues dealt with in an extensive agenda included:

1. **Funding and sustainable financing of reception facilities for ships' wastes**

The subject-matter's importance to ports stems from a tendency in many parts of the world for Governments to want to devolve responsibility for the provision of reception facilities to local Port Authorities. The logistics of assuming such responsibility need to be fully examined in the context of local circumstances and after an assessment of available options.

2. **Air pollution from ships including fuel oil quality**

If agreement can be reached on a number of contentious waste issues IMO will prepare a new Annex to the MARPOL 73/78 Convention dealing with Air Pollution. Ideally ports should be detached from this development. As matters stand at the present time however, some proposals involve ports directly in fuel quality control and others have an impact on inter-port competition. IAPH has questioned the validity of such proposals.

3. **Unwanted aquatic organisms in ballast water**

The full extent of the problem on a global scale is as yet unclear and much scientific research needs to be carried out before practical solutions can be put in place.

An IAPH survey of the amounts of ballast water loaded and discharged at member ports is continuing. Results obtained thus far clearly show the enormous amount involved and already demonstrate the impracticability of discharging ballast water to shore reception facilities.

4. **An environmental policy for ports**

The essential elements of an Environmental Policy Statement which could be endorsed by ports generally are currently under consideration. Amongst other things the Statement would serve as an umbrella for sub-policies on Waste Management and Health and Safety, on which work has already started.

5. **Health and safety at Ports Newsletter**

As a follow-up to an Executive Committee (ExCo) decision at the Seattle Conference much progress has been made in developing a Newsletter format and content list to the point where it can be submitted for ExCo's approval.

6. **The use of Tri-butyl-tin (TBT) on ships' hulls**

TBT as an anti-fouling measure can have an adverse effect on a port's water quality, and over time end up in spoil which can give rise to disposal problems. This issue is currently being addressed by IMO and, whilst it is primarily a shipping problem, the spin-off effect on ports cannot be disregarded.

7. **Emergency preparedness and response**

The Committees have been advised of the need to develop basic guidance to ports on the preparation of plans dealing with the range of emergencies likely to have an effect on ports, with the exception of those relating to oil and chemical incidents.

8. **Bulk carrier safety**

The Committees have taken part in the development of a ship/shore safety check-list for bulk carriers for distribution to and implementation by ports, terminals and bulk carrier shipping worldwide.

Under the aegis of IMO, consideration is now being given to ways and means of giving effect to what is generally agreed to be a very useful input to securing bulk carrier safety.

9. Hydrographic surveying/charting

Efforts are being made to identify problems and possible solutions to inadequacies in hydrographic survey and charting which are apparent in various parts of the world. A specific input is also being made to related and ongoing work being carried out by the Southern African Ad Hoc Regional Co-operation Group in Tanzania and Kenya.

10. Vessel Traffic System and ship reporting

Earlier advice on Vessel Traffic System (VTS) provided by IAPH and circulated in Port Safety Guidelines needs to be updated in accordance with current developments in IMO on this subject. Emphasis has been placed on providing concise and impartial information on VTS capable of being adapted for local use by the smaller port members of IAPH.

11. Wreck removal from port waters

Note has been taken of the need to provide a technical port-oriented input to work being carried out by IMO on a draft Wreck Removal Convention, the current priority of which is low. Preliminary consideration is being given, however, to issues which should be addressed, including the reception of disabled ships into port waters.

12. Next meeting

It is highly likely that the joint Committee meeting approach will be continued at the next meeting scheduled to be held in Houston on 9-10 December 1996 though that will be confirmed later. Information on matters which should be included on the agenda will be welcome. (Source: *Ports and Harbors*, July-August 1996)

Global shipbuilding requirements to year 2005

In May 1993 the Association of European Shipbuilders and Shiprepairers (AWES) Working Group on Market and Forecast issued a forecast on the requirement for new merchant ships to be built in the period up to the year 2005—"*Review on Global Shipbuilding Requirements to 2005*". The Working Group has been reviewing this forecast in 1995 in the light of new developments occurring since the preparation of the forecast.

According to the preliminary figures of the forecast review, there is foreseen a requirement for 160 million cgt to be completed during the period from 1 January 1995 to 1 July 2005 of which half is forecast to be required in the period until the end of the year 2000 and another half in the latter period, from 1 July 2000 to 1 July 2005.

These requirements correspond to an average yearly production volume of some 14.5 million cgt in the first period and 16 million cgt per annum in the second period.

As for the yearly average of new-building requirement of 16 million cgt forecast for the period from 1 July 2000 to 1 July 2005, it should be noted that in this period it is assumed that the yearly requirement could reach a maximum of up to 17-18 million cgt per annum in the years 2001 and 2002, after which the new-building requirement is projected to decline again reaching a level of around 15 million cgt in 2005.

The main reason for the increase and subsequent decline in new-building requirements in the forecast period is the need for replacement of old ships built earlier—especially replacement of ships built in the 1970s and earlier.

A total of 314 million d.w.t is forecast to be deleted during the forecast period due to scrappings and losses, some 173 million d.w.t. of which in the period till mid-2000 and 141 million d.w.t. in the following five-year period.

More than 80 per cent of the new-building comes from the need to replace obsolete ships and ships removed from the fleet due to accidents. The new-building requirements for future years are thus very sensitive to decisions of shipowners as to when ships are to be scrapped. This again is influenced by numerous factors including the age-profile of the existing fleet together with current and expected future freight rates, maintenance and running costs, legislation, etc.

Global shipbuilding capacity

Apart from the requirement for new ships to be built, the possibilities of the shipyards to meet this requirement plays an important role in the development of the new-building market.

The AWES Working Group on Market and Forecast issued a report thereon—"*Review on World Merchant Shipbuilding Capacity*"—in autumn 1995. This report confirms that a surplus of shipbuilding capacity in the world will likely exist for the remaining part of this century and well into the next.

The completions of merchant ships have globally decreased from 20.7 million cgt in 1975 to 8.5 million cgt in 1988, corresponding to a decrease of 59 per cent. In the following years production has gradually increased to 14.3 million cgt in 1995—a level still 37 per cent lower than that reached in 1975.

The available capacity has during the same period also decreased, though to a lesser extent than the production. However, during the last couple of years there has been a tendency for some countries to increase their shipbuilding capacity. The development in global available capacity for the period 1975-2000 is shown in the following table.

Such capacity increases come in addition to capacity increases originating from the ongoing productivity increase within the shipbuilding industry and other developments such as transfer of naval shipbuilding capacity to the building of commercial ships.

As can be seen, the capacity which is readily available for commercial ship new-building is substantially larger than the forecast volume of ship new-building requirements for the future years. Furthermore, the potential capacity which can be used for commercial shipbuilding is much larger than the available capacity.

The potential capacity—i.e. the capacity which could be active in shipbuilding if the market so requires—is estimated at 24.5 million cgt in the year 2000 up from 22.7 million cgt in 1997 and 20.7 cgt in 1994. The potential capacity, among others, includes capability of mothballed facilities and further utilization of active facilities corresponding to the performance of not hired, but recruitable expertise in design, engineering, planning, etc. and of skilled workers.

When comparing the development in new-building requirements with that of shipbuilding capacity, it seems probable that the current surplus of shipbuilding capacity will grow substantially over the coming years, especially after the year 2002 when the building of replacement tonnage is forecast to start declining.

Shipbuilding capacity in million CGT

	1975	1980	1985	1990	1994	1997	2000
AWES	8.5	5.5	4.4	3.5	4.2	4.4	4.6
Japan	9.0	7.0	6.5	5.5	5.8	6.4	6.8
South Korea	0.4	0.6	1.7	1.8	2.4	3.4	4.1
Other free market economies	1.7	1.9	2.0	2.1	2.0	2.2	2.4
Former Centrally-Planned Economies	2.5	2.2	2.2	1.6	1.9	2.0	2.2
China	0.3	0.5	0.4	0.5	0.5	0.5	0.7
World	22.4	17.8	17.2	15.0	16.8	19.0	20.8

Remarks: Excluding Poland which joined AWES in 1995. (Source: *AWES Annual Report 1995-1996 (Association of European Shipbuilders & Shiprepairers)*

Independent world commission on the oceans

In the lead-up to 1998—the International Year of the Oceans—an independent commission on the oceans has been established. According to its terms of reference, the Commission will work over the next three years to:

- Seek to develop world consciousness of the unique role of the oceans for planetary survival and of the critical importance of rational management of ocean space and resources, including their interaction with rivers and land-based activities;
- Draw the attention of world leaders and the public at large to emerging issues relating to ocean development and the direct or indirect impact of human activity on ocean resources;
- Encourage the further development of the ocean regime emerging from the United Nations Convention on the Law of the Sea in the light of changing scientific perceptions and discoveries, with particular attention to the problems and needs of developing countries;
- Study the interactions between the Law of the Sea Convention, Agenda 21 (in particular Chapter 17 which deals with the Seas and Oceans), the Biodiversity Convention, the Climate Change Convention and other recent treaties, agreements and programmes, and explore ways of utilizing overlaps for enhancing the implementation of each;
- Examine the economic potential of the oceans, including fisheries and future developments in aquaculture and in mariculture; desalination for agricultural and domestic purposes; mineral and energy production; sea-borne trade and ocean-dependent tourism; marine scientific research and technology development; as well as the equitable distribution of these goods and services;
- Analyse the requirements of integrated coastal management and the impact of the conclusions of the World Conference on Population, the World Conference on Habitat, the Agreement on Straddling Fish Stocks and Highly Migratory Stocks, the World Conference on Small Island Developing States, as well as of trade and coastal tourism on integrated coastal and ocean management;
- Explore new forms of North-South and South-South cooperation in joint technology development;
- Study the dangers threatening the seas and oceans and the viability of their living resources and of marine biodiversity; the potential implications of sea-level rise and global warming and its social and economic impacts;
- Endeavour to define modalities for strengthening the institutional framework for ocean governance at various levels;
- Contribute to the interpretation and development of the concepts of the peaceful uses of the oceans and the reservation of the oceans for peaceful purposes as well as the potential contributions of ocean governance to the implementation of the United Nations Secretary-General's Agenda for Peace.

The Commission will encourage the ratification and implementation of the United Nations Convention on the Law of the Sea and the implementation of Agenda 21 (in particular, its Chapter 17). Furthermore, the Commission is to cooperate closely with the United Nations Secretariat, UNESCO, other agencies and programmes of the United Nations system competent in ocean affairs, and with other intergovernmental as well as non-governmental organizations, at the national, regional and global levels.

For further information, contact: Independent World Commission on the Oceans, 14, avenue de Joli-Mont, 1209 Geneva, Switzerland. (Source: *South Letter*, Vols. 1 & 2, 1996)

Helsinki Commission adopts pollution-reduction recommendations

The seventeenth meeting of the Helsinki Commission took important steps concerning the reduction of pollution from the transport sector related to both land-based traffic and shipping. Two important recommendations were adopted.

The first concerns reduction of emissions from land-based transports which are seriously affecting the Baltic Sea environment. For the first time, the Contracting Parties have agreed on comprehensive joint actions in this field including the implementation of the polluter pays principle (PPP) and the introduction of best available technology (BAT) for vehicles and fuels.

The second—equally important—recommendation aims at reducing the increasing number of illegal discharges of oil and other substances at sea. It concerns reception facilities in ports and includes a harmonized system of raising fees, harmonized sanctions for offenders and mandatory rules to deliver garbage to port. (Extracted from *HELCOM News*, No. 2, April 1996)

Helsinki Commission Combating Manual

The Commission adopted HELCOM recommendation 17/13 on the Use by the Baltic Sea States of the Manual on Cooperation in Combating Marine Pollution within the Framework of the Convention on the Protection of the

Marine Environment of the Baltic Sea Area (Helsinki Convention). The Contracting Parties will use the revised Manual.

The Combating Committee had decided to simplify and substantially revise the contents of Volumes I and II of the present HELCOM Combating Manual as well as to harmonize some of their chapters with the relevant Manuals being in use within the Bonn and Copenhagen Agreements. Both Volumes I and II of the present Manual are amalgamated in one Volume I, which is divided into two Parts. Part I is addressed to contingency planners and contains information on general guidelines for cooperation. Part II is addressed to field personnel and deals with operational matters. The present Volume III remains unchanged. However, in accordance with the decision of HELCOM 16, the Combating Committee approved the HELCOM Guidelines to authorities in dealing with chemical munition caught by fishermen and requested the Secretariat to distribute them to the users of the Manuals a new Chapter 3.5 to Volume III. (Extracted from *HELCOM News*, No. 2, April 1996)

Delimitation of response regions

The Commission encouraged the Contracting Parties to facilitate bilateral negotiations on the delimitation of their response regions in accordance with paragraph 1 (a) of Regulation 7 of Annex VI of the Helsinki Convention.

The reason for this decision is that HELCOM Recommendation 2/7 concerning the Delimitation of Response Regions for Combatting Marine Pollution is not fully implemented, since all the Contracting Parties in accordance with Part V of the Law of the Sea Convention have established or are in the process of establishing their exclusive economic zones. For the time being only eight out of 18 possible bilateral agreements on the delimitation of response regions are in force. For the purpose of responsibilities to respond to marine pollution, some countries use areas declared and delineated as their respective exclusive economic zones or fishery zones. Clear information on the responsibility of a coastal State to conduct response operations is of utmost importance for the implementation of the HELCOM combating arrangements. The Commission also drew the attention of the Contracting Parties concerned to the Law of the Sea Convention, paragraph 3, Article 74, concerning delimitation of the exclusive economic zones between States with opposite or adjacent coasts. This provision stipulates, *inter alia*, that the States concerned, in a spirit of understanding and cooperation, shall make every effort to enter into provisional arrangements of a practical nature and, during the transitional period, not to jeopardize or hamper the reaching of the final agreement; such arrangements shall be without prejudice to the final delimitation. (Source: *HELCOM News*, No. 2, April 1996)

Baltic Sea strategy

The Commission adopted HELCOM Recommendation 17/11 on Reception Facilities which constitutes a part of the Baltic Strategy for Port Reception Facilities for Ship-Generated Wastes and Associated Issues.

The Commission endorsed the Baltic Strategy for Port Reception Facilities and Associated Issues and the Project on follow-up of the Baltic Strategy.

The main goal of the Strategy is to fully implement the regulations on reception facilities as laid down in MARPOL 73/78 and the Helsinki Convention in order to substantially decrease operational discharges and to eliminated illegal discharges of ships' wastes. The Strategy addresses the operation of reception facilities and stresses, *inter alia*, a need for development in the entire Convention Area of a harmonized fee system for the use of reception facilities, and a harmonized system for determining the severity of sanctions to be imposed on a ship violating anti-pollution regulations as well as mandatory rules to deliver all garbage to port. The Strategy also comprises measures to be taken on board ships as well as by port authorities and administrations.

An investment programme to improve reception facilities in the countries in transition also constitutes a part of the Strategy. The total need for investments, including feasibility studies, is about US$ 37.5 million. The implementation of the strategy has already been initiated; preliminarily it is foreseen to take two years. (Source: *HELCOM News*, No. 2, April 1996)

Fishermen ready for EEZ impact

With the decisions of South Korea and Japan to declare each country's exclusive economic zone (EEZ), the National Fisheries Administration (NFA) is mapping out a package of measures to help Korean fishermen minimize possible losses which could be brought about by the moves.

Drawing the EEZ border lines would have an immediate economic impact on the South Korean fishing industry.

Accordingly, the NFA is now checking out possible losses Korean fishermen might suffer from the establishment of the EEZ border line and mulling over ways to help them avoid or reduce the losses.

In case Korean fishermen are totally banned from engaging in fishing operations in Japanese and Chinese waters, the NFA will help fishermen seek other fishing grounds or convert their jobs into other kinds of fishery businesses.

At the same time, the NFA is moving to reduce the total number of Korean fishing vessels, now standing at around 77,000, by about 10 per cent during the period from 1996 to the year 2000 in a bid to strengthen the external competitiveness of the nation's fishing industry.

Through business consultations with relevant government agencies, the NFA also plans to allow foreign crews to go abroad Korean ships doing offshore and inshore fishery operations in an attempt to solve the serious shortage of skilled crew members.

Currently, foreign crews are permitted only to go aboard Korean ships engaging in deep-sea fishery operations.

The setup of the EEZ border line would not mean immediate losses for Korean fishermen as the existing fishery pact between South Korea and Japan will continue to be in effect until the end of 1996. In keeping with the international trend under which some 95 countries have proclaimed the 200 nautical mile zone off their coast, the Seoul Government should establish the EEZ, while seeking a new and promising fishing order with Japan and China to avoid acute impacts on the current fishing system. (Source: *Newsreview*, 2 March 1996)

International Harbour Masters' Association (IHMA)

The IHMA was launched on 21 June when the members of the European Harbour Masters' Association (EHMA) voted unanimously to establish the new association.

IHMA was inaugurated in Reykjavik on the occasion of the EHMA's sixth biennial congress which included an

impressive programme of speakers under the congress theme "Environmental Protection—a Mutual Awareness".

The links between EHMA and IHMA have been well established. EHMA members automatically also become members of IHMA. Both the structure and the work programme of IHMA have developed from its close links with the European Association which established an "IHMA Founding Group" in 1994 to prepare the way for an International Harbour Masters' Association. Modern information technology will play an important part in keeping members informed and a database of their skills and expertise is already being developed.

Captain H.-J. Roos, harbour master of Bremen, was elected to be the first president of IHMA, which starts with a membership in excess of 250 in 53 countries, including 25 sponsoring commercial members. Captain Roos is also chairman of the IMO's Working Group on Ship/Port Interface (SPI). Membership is rising steadily and IHMA has a constitution and structure in place based on individual membership plus a regional structure where it is appropriate. IHMA now looks forward to cooperating with other organizations in the maritime field.

Further information and details about membership are available from Captain R. A. Gibbons, Secretary, IHMA, 57 Gloucester Road, Almondsbury, Bristol BS12 4HH, UK (Tel.: +44 1454 612291. Fax: +44 1454 201851) (Source: *The Dock & Harbor Authority*, June 1996)

H. SOFTWARE

Small vessels and the Internet

Instant access to the much-vaunted global information infrastructure is now possible even from the smallest vessels afloat following a major service breakthrough from satellite communication provider Inmarsat.

The breakthrough came during the first quarter of this year when two of the organization's signatory service providers, BT and Telstra, launched Inmarsat-M data services from their land-earth stations in England and Australia.

The Inmarsat-M service now provides a fully global, mobile, data communication service that will allow operators of vessels fitted with suitable terminals access to dial-up data networks, such as the Internet, even while they are at sea.

With its small, lightweight terminals and antennas, the Inmarsat-M service is primarily aimed at smaller vessels.

Inmarsat believes the new data service will be of particular interest to operators of yachts and fishing vessels.

Three Inmarsat terminal manufacturers—Nera, STN Atlas and Thrane and Thrane—all now offer Inmarsat-M terminals with data capability and software upgrades for existing terminals.

To coincide with the launch of the new service, Inmarsat has published a guide for users of both the Inmarsat-M and the longer-established Inmarsat-B data services.

The guide provides a simple introduction to the systems and explains how to use them most effectively. (Source: *Ocean Voice*, April 1996)

First ECDIS-only ships get official go-ahead

Three Dutch tankers are set to become the world's first vessels to rely almost exclusively on electronic chart displays (ECDIS) for navigation.

Dutch maritime authorities have sanctioned a trial which will mark a major breakthrough in the march towards world-wide acceptance of ECDIS as the prime navigation system aboard ships.

The three vessels are new-buildings, to be operated by Broere Shipping and Theodora Tankers for the Pakhoed Group.

The first, *Dutch Spirit*—one of two 4,500 d.w.t. chemical tankers built at Verolme Heudsen for Broere—was handed over in mid-February.

Each ship will be fitted with a Racal-Decca Chartmaster ECDIS as part of a Mirans integrated bridge system. The charts themselves will be raster-scan charts supplied by the British Admiralty's ARCS service.

The trial, which has been authorized by Holland's Directorate-General of Shipping and Marine Business, requires each ship to be fitted with two independent Chartmaster systems, plus paper charts of their principal operating areas as back-up.

Although the charts used in this experiment are raster-scan charts and must be updated by replacement, the trial is seen as a crucial milestone on the road towards implementation of fully vectorized electronic charts that can be updated by satellite.

The Chartmaster displays carried aboard the three vessels are capable of displaying vectorized charts but a similar experiment using this type of chart awaits the availability of more vectorized charts with official sanction from hydrographic authorities. (Source: *Ocean Voice*, April 1996)

The European Mermaid Project

The term "telemedicine" was first coined in the 1970s by the medical scientist Thomas Bird. It refers to the delivery of health care to distant patients through telecommunications technology.

Today, telemedicine means live, interactive audio-visual communication between physician and patient or between two physicians. It requires crystal-clear, instant voice and image transmission that closely approaches face-to-face communication.

It was against this background that a consortium, called Mermaid, was set up within the European Union General Directorate XIII Healthcare Telematics Programme, to provide "Medical Emergency Aid" through Telematics.

In its search for a suitably isolated community that would be willing to participate in the development of a global telemedicine model, Mermaid turned to the shipping industry.

Merchant ships operate under circumstances that resemble closed, isolated, remote regions and communities. While at sea, they must be completely self-reliant. Medical needs must be fulfilled with the absolute minimum of outside help which, in the absence of telemedicine, implies that the means and knowledge necessary for handling emergencies must reside on board.

Nevertheless, even ordinary medical emergencies at sea, when managed by inexperienced personnel, can easily evolve into critical situations.

At present Mermaid is working with some 80 ships, representing approximately 1 per cent of the world's gross tonnage. It is expected that, by 1998, telemedicine facilities will be installed in over 300 ships, representing more than 5 per cent of the world's gross tonnage.

A key element in the Mermaid system is the provision of a means by which a doctor ashore can visually examine a patient aboard a ship at sea.

Visual inspection is an important part of any formal medical examination. To overcome the absence of face-to-face contact during a telemedical consultation, Mermaid uses two-way transmission of live images via Inmarsat satellites.

The system revolves around a physician at a central location who is connected to a number of ships and conducts his medical teleconsultation using either two-way voice and video with zoom-focus facilities or appropriate portable equipment.

When a teleconsultation is under way, a third person may, typically, be required to assist the patient. This assistant dons a headset containing a camera, a small visual display, microphone and earphones. This makes it possible to create a strong sense of shared presence with the remote doctor, a concept known as "telepresence".

The communication can thus be focused precisely on the medical problem at hand, such as examination of certain areas of the body or administration of first-aid procedures. The doctor gets the same view as the operator

and the remote consultation can take place more naturally in "real time".

For this approach to be effective, certain requirements must be met. The viewing angle must be greater than 80 degrees so that the viewer has the illusion of being immersed in the image.

The definition of the image must be sufficiently high as to convey a feeling of reality. The physician must be able to control what he sees by zooming, extracting and moving the camera. Sound originating from the image or its source must be added to make the image of reality complete.

But telemedicine cannot provide the complete solution to the problem of remote medical care. Although it transports the physician's expertise to the patient, telemedicine is still critically dependent on local paramedics. Merchant marine officers are normally trained in first-aid procedures and other basic medical transactions, including supplying medication for most common conditions. In practice, however, this training often proves inadequate.

As a result, it has been established that there is a need for standardized, reliable and easily-accessible medical information on board. Mermaid is using a multi-media application that covers the basic medical knowledge necessary for handling medical emergencies and common medical problems on board. This application is based on the World Health Organization "International Medical Guide for Ships", the relevant guides of the British and US authorities and Council Directive 92/29.

Administrative aspects must be addressed, too. Best practice requires that a minimal medical record of the patient be kept aboard if the teleconsulting physician is to be in the best position to help. In the Mermaid project, the choice of providing the necessary information or not rests with the individual crew member and it can be exercised either at the start of the trip or during the emergency.

The record is not transferable, but it remains aboard at all times and, to maintain confidentiality, can be consulted only by the tele-attending physicians and only during the course of the emergency.

The Mermaid system allows the transmission of high-resolution still pictures that allow the teleconsulting physician to examine his patient visually in great detail, as well as for the transmission of other relevant signals such as stethoscope sounds and ECG recordings.

Through telepresence, via satellite, Mermaid is bringing about a huge improvement in telemedical services which, until now, have had to rely on short-wave and VHF radio as the only means of remote communication.

The Mermaid consortium, despite its small capacity, is attempting to provide the merchant marine community with a health telematics system that represents a quantum leap over existing merchant marine telemedical systems. (Source: *Ocean Voice*, April 1996)

Simulated voyages

Major shipping accidents have focused public attention on the performance of marine pilots and deck officers. Headline-grabbing accidents have occurred with all types of commercial vessels—cargo haulers, tankers, passenger ships and towing craft. Human error often has been a contributing factor.

As a result, more attention is being paid to the training, performance evaluation and licensing assessment of mariners. A new report by a US National Research Council committee says that computer ship-bridge simulator training, a tool that has been used for several years, could be made much more effective in training and evaluating mariners.

The US Coast Guard should develop and promote standardized training and testing methods for ship-bridge simulators; and it also should establish a research base to measure the effectiveness of simulation in training for specific tasks according to a study requested by the Coast Guard in response to the Oil Pollution Act of 1990.

Simulators have been used for mariner training worldwide since the 1960s. Their capabilities range from radar screens to full-scale devices that can create a 360-degree view from a ship's bridge. The technology can be used for many types of vessels to create real scenarios or generic operating conditions that occur in ports or harbours. The devices offer several significant advantages, most notably a safe environment where mariners can train without worrying about inclement weather conditions or other hazards. Mariners can be trained in a number of skills, from "rules of the road" and emergency procedures to bridge team and resource management. Instructors can terminate or repeat scenarios at any time.

The committee said that a more structured approach to simulation training would offer the most benefit. Instructors who use simulation as a tool should themselves be trained and certified to ensure that the course objectives are being met.

Testing mariners for licensing with simulated programmes offers an effective method for assessing not only the candidate's knowledge, but also his or her ability to apply it. Ways of approaching tasks and aptitudes for performing several duties simultaneously also can be evaluated. Before undertaking more extensive use of simulation in marine licensing, the Coast Guard should develop a framework for integrating accurate, consistent simulation into its licensing programme. Since there are no industry-wide standards, the Coast Guard should develop its own, and monitor systems regularly.

Simulated Voyages: Using Simulation Technology to Train and License Mariners. Committee on Ship-Bridge Simulation Training, Marine Board, Commission on Engineering and Technical Systems (1996, 284 pp.; ISBN 0-309-05383-8; available from the National Academy Press, Tel.: 1-800-624-6242; $38 plus $4 shipping for single copies). (Source: *News Report*, Spring-Summer 1996)

Aids to navigation

PinPoint develops world's first ECDIS system

PinPoint Systems International has developed PC ECDIS with Radar Overlay, and IMO/IHO compliant electronic chart display and information system (ECDIS) designed for commercial vessels. It is the world's first ECDIS system to simultaneously display raster and vector charts with real-time enhanced radar overlay on a PC platform.

The Washington DC-based company is one of the world's fastest growing developers and manufacturers of state-of-the-art electronic navigation systems. It is claimed to be the only firm offering a complete range of marine navigation and electronic chart products for every market.

The PC ECDIS system can be configured as software only installed on a compatible PC, or incorporated into a ruggedized deck console. It can be completely integrated with vessels' bridge systems, interfacing with multiple navigation sensors. The exclusive R3000 radar overlay option takes the raw radar signal, processes it and then

displays an enhanced image over the raster or vector chart. The scan-to-scan conversion process reduces sea clutter while "blooming" small radar targets.

PC ECDIS is compliant with the IMO standard for ECDIS and supports the following data formats: Canadian Hydrographic Service, NOAA/BSB, NOS, GEO, ARCS (British Admiralty) raster charts, CMP-93 (Cmap's vector data) and the IHO SP-57 data format, formerly referred to as DX-90. The system is not limited geographically as it reads both raster and vector data available from official hydrographic offices in addition to proprietary data.

The whole navigation system has been designed to be easily updated so that it will always meet the IMO and IHO standards. Computer requirements include a minimum of a Pentium 586 processor with 32 MB RAM, 2 MB SVGA, 1280 x 1024 video, 3.5 inch floppy drive, CD-ROM drive, and serial ports for sensor inputs.

The navigation system includes a voyage manager with built-in data log for recording voyage data, unlimited route creation, unlimited waypoints per route, route creation across multiple charts, a route monitoring system, extensive route and waypoint editing facilities and chart updating. (Source: *The Dock and Harbour Authority*, June 1996)

Port of Brisbane

A new high-tech system for measuring channel depths in relation to ship under keel clearances will mean major efficiency gains for bulk carrying vessels calling at the port.

The Port of Brisbane Corporation is developing the fully computerized Under Keel Clearance System in close consultation with the regional harbour master and Brisbane Marine Pilots Pty. Ltd.

The new system is only the third of its kind in Australia. Similar systems operate in the ports of Fremantle and Hay Point, where bulk trades have been able to maximize vessel loadings due to more accurate channel depth predictions based on real-time data.

The Under Keel Clearance System will use continuous tide and wave height recorders located in critical sections of the port's channels in Moreton Bay to measure actual sea conditions. This information will be integrated with accurate modelling of current velocities, individual vessel specifications, vessel speed, bed level data and other port operation constraints. (Source: *The Dock and Harbour Authority*, June 1996)

Cruise lines get turn-key communications service

Comsat has announced a novel service package that could revolutionize the way cruise lines purchase and operate on-board communication facilities.

Under the new service, Comsat offers to create and administer a complete, turn-key communications facility for a cruise ship, including purchasing new equipment and employing new staff. What is more, Comsat pledges to turn the on-board communication facility into a profit centre and pay the cruise line a percentage of its revenue.

The service begins with Comsat and the cruise line together evaluating the current communication equipment aboard the ship and deciding what additional equipment, if any, would be needed to maximize revenue and business efficiency. Comsat would provide the additional capital required for any new equipment and take responsibility for maintenance and repairs.

Comsat would then hire a GMDSS-qualified radio crew for the vessel, sparing the operator the expense of recruitment and training. The crew would be trained in the value-added services offered by Comsat and in billing and accounting, as well as use of the equipment itself.

The shipboard staff would also take care of marketing and promoting the communications facility on board the vessel to maximize call revenues for the cruise line. Comsat would supply information, advertising and promotional material.

Initial trials of the service have already taken place aboard a number of high-profile vessels in the Cunard fleet. (Source: *Ocean Voice*, July 1996)

Tanker owners urge better traffic control

Intertanko, the International Association of Independent Tanker Owners, has called for greater use of non-voice communication in vessel traffic management systems.

Delegates at the eighth International Symposium on Vessel Traffic Services in Rotterdam were told that every vessel traffic system must be based on international compatibility, have efficient communication, be compatible with transponders and have coverage for all areas. Wherever possible, given the tendency for overloading VHF circuits, the transfer of information should be voiceless.

The speech comes against a background of increasing calls for satellite-based vessel control, culminating in US President Clinton's move to legislate for satellite-based vessel traffic management for tankers operating in the Alaskan North Slope oil ports. (Source: *Ocean Voice*, July 1996)

Diesel engine fault diagnostic system

Macsea says Dexter uses artificial intelligence rather than a rule-based expert system to diagnose problems as soon as they develop and thus allow operators to take preventive action before failure occurs. The product can be installed on a stand-alone computer or a local area network. (Source: *Ocean Voice*, July 1996)

Data transfer between local area networks (LAN) via satellite

Called Lancom Satlink, this automatic router/bridge from Livewire Digital provides the necessary interface between a shipboard LAN and the Satcom terminal, and between the land-based ISDN network and the office LAN ashore. It operates via the Inmarsat-A or Inmarsat-B high-speed data services.

An early installation of a Lancom Satlink is aboard a German research vessel, where it is used to transfer data via Inmarsat-B from the vessel to a research centre ashore. (Source: *Ocean Voice*, July 1996)

Shore-based graphical information system

Amos Fleetplot is the latest addition to the Amos family of maritime software products from Spectec. The company says it is specially tailored to meet the increasingly complex demands of modern fleet managers and owners.

Fleetplot provides land-based offices with ready access to fleet status without the need for expensive additional on-board equipment. It operates via Inmarsat-C and is compatible with all terminal types. It will automatically

provide a "noon position" or more frequent updates for up to a hundred vessels.

Each ship is clearly positioned and identified by name on an electronic chart, allowing a quick and easy assessment of a fleet's current situation. The system comes with charts covering all major trading areas, and users can add their own customized charts and overlays to give even greater detail on specific areas such as major ports. (Source: *Ocean Voice*, July 1996)

Complete GMDSS console system

Sea Inc., a unit of Datamarine International, has launched the SEA 400-A3 GMDSS console, which integrates all the basic carriage requirements for GMDSS area A3. The console enables vessel operators to buy a complete GMDSS-compatible communications system ready for installation on board.

Sea Inc. claims to be the only US manufacturer with a complete line of products type-approved by the US Federal Communications Commission for GMDSS. Until now, the company had provided products for use in other companies's GMDSS consoles, notably VHF and HF radio equipment.

According to the company, the introduction of its turn-key GMDSS console is indicative of its growing prominence in the marine communications market. As well as the console itself, it offers full training through a world-wide network of dealers and service stations. (Source: *Ocean Voice*, July 1996)

Three new training products from PC Maritime

Safe Passage is the first multi-media teaching and testing software based on the international collision regulations. In line with the revised STCW requirements, it includes a system for recording student performance and a testing module designed to be administered under supervision for formal evaluation and certification.

It contains a vivid animated depiction of all 37 rules, with almost 50 film clips and voice-over instruction.

Stability for Ship Operations and Stability for Naval Vessels also use interactive graphics and animation, with structured examination sessions based on the US Coast Guard's licensing requirements. An optional management tool gives instructors tools for logging and monitoring the progress of up to 30 students simultaneously. (Source: *Ocean Voice*, July 1996)

Keeping clippers in ship-shape condition

Star Clippers, the Florida-based cruise company, has selected the Marine Management Systems (MMS) Fleetworks inventory and maintenance system for their two ships, *Star Clipper* and *Star Flyer*.

The two vessels, designed in Holland to mirror the square-rigged clippers of the nineteenth century, offered an interesting challenge to the MMS software engineers, who had to define new fields in the software for the unusual spare parts and maintenance procedures associated with operating a large sailing vessel. (Source: *Ocean Voice*, July 1996)

Satellite-based weather forecasting

In the unforgiving waters of the North Sea, both commercial success and safety depend on accurate weather information.

Earlier this year, the UK Meteorological Office (MO), in conjunction with Inmarsat signatory BT, launched a satellite-based weather forecasting service that is proving a hit with fishermen in the region.

Dubbed "Fleetmet", the service delivers a five-day synopsis and forecast, together with a three-day forecast of wind conditions, directly to subscribing vessels. The information is broadcast every day at 05.30 hrs, is routed via Inmarsat-C directly into PCs already aboard the fishing boats. According to the MO this service offer the most up-to-date information available.

The service was launched commercially after a six-week free trial. More than 270 vessels in the region are now fitted with Inmarsat-C transceivers and they anticipate that take-up of the weather service will be high. (Source: *Ocean Voice*, July 1996)

Web sites

Selections from Cyberspace

MTS at http://www.cms.udel. edu/mts
MTS *Currents* lists sites of interest to MTS members.
Consortium for Oceanographic Research Education (CORE) at http://core.cast.msstate.edu
Good updates on the Washington scene along with CORE reports and information about the organization.
Ocean Drilling Program at http://www.odp.tamu.edu/index.html
The organization, the data, the vessel statistics, the drilling/rigfloor equipment, the people, the schedule, the publications and more.
Deepsea Research Newsgroup. http://www.bio.net:80/hypermail/DEEPSEA/
An electronic forum for deep-sea and hydrothermal vent/sleep biologists oceanographers and geologists. Frequent uses include searches for specialist literature or opinion, specimen exchange and discussions on deep-sea topics.
Online Earth Science Journals at http://www.ncpgg.adelaide.edu.au/journals.htm
A comprehensive list of on-line geoscience journals and publications compiled by Australia's National Centre for Petroleum Geology and Geophysics.
Research Ship Information and Cruise Schedules at http://www.cms.udel.edu/ship/ship_menu.html
This is the place for information about research vessels. Includes US and foreign ships, and can be searched by ship name or country.
UCLA Ocean Discovery Center Home Page at http: //stratus.lifesci.ucla.edu/msc/odc/ index.html
Information about this K-12, interactive marine science learning centre, which is located at the Santa Monica Pier, in Santa Monica, CA.
Institute of Ocean Sciences, Fisheries and Oceans (Canada) at http://www.ios.bc.ca
IOS organization, activities, personnel, events, programmes, and links to other ocean sites.
Global Maritime Distress and Safety System (GMDSS) at http://www.navcen.uscg.mil/marcomms/gmdss/gmdss.htm.
Det Norske Veritas at http://www.dnv.no.
Germanischer Lloyd at http://www.germanlloyd.de).
Inmarsat Home Page at http://www.worldserver.pipex.com/Inmarsat/.
The UK marine specialist service provider Sea.Net at http://www.seanet.co.uk.
Marine related suppliers at http://www.mglobal.com/vendor_services.html.

I. PUBLICATIONS

Dangerous marine animals that bite, sting, shock, or are non-edible

by Bruce W. Halstead, M.D.

Hardcover. 288 pp. Cornell Maritime Press

This book is a compact guide to the world of underwater animals that are poisonous, venomous, or electric. This third edition book describes and fully illustrates these dangerous marine animals, their noxious effects, treatment of ailments resulting from them, and—most importantly—how to avoid them.

The illustrations show the animals in their true forms, natural habitats, and in detail, allowing the reader to identify all parts of the various organisms on sight.

Beach nourishment and protection

Hardcover. 334 pp. National Research Council, USA. $44.95

Efforts to restore beaches and stabilize shorelines by replacing sand lost to erosion have been undertaken for decades in the United States. This new book supports beach nourishment as a viable method for protecting the shoreline from erosion and for restoring lost beach. In doing so, the book addresses six issues about beach nourishment as a method of beach preservation: (1) how it works; (2) how success is measured; (3) economic feasibility; (4) possible areas of improvement; (5) the role of fixed structures; and (6) the role in flood protection and disaster assistance.

Marine technology and transportation

Edited by: T. Graczyk, T. Jastrzebski, C.A. Brebbia and R.S. Burns

Hardcover. 848 pp. Computational Mechanics. $375

This book contains the papers presented at the first International Conference on Marine Technology (ODRA 95)—which was held in Sczczecin, Poland, in September 1995. The Conference's purpose was to promote technological progress and activities, to create opportunities for engineers to maintain and improve technical competence, and to provide an international forum for technical cooperation and fellowship among researchers and engineers.

The book also contains the proceedings of the first international conference on marine transport, MarTrans 95, held in Plymouth, UK, in August.

Cage Aquaculture

Second edition by Malcom C. M. Beveridge.

Published by Fishing News Books, 1996

Cage aquaculture continues to play an important role in the world production of food fishes. This authoritative book on the subject is the result of many years of study by the author who has carefully examined the techniques used in cage culture. The second edition has been updated to cover recent developments and includes expanded sections on cage design, site selection and environmental issues. In addition, alternatives to cages, such as floating raceways, are considered and the future of cage aquaculture is discussed taking into account current legislative and economic trends.

Available in paperback at £29.50 from Fishing News Books, Blackwell Science Ltd, Osney Mead, Oxford OX2 0EL, UK.

New publications from IMO

STCW 95

The annex to the STCW Convention of 1978 has been revised and supplemented by a new STCW Code, which is divided into part A (mandatory technical standards) and part B (guidance to assist those who are involved in educating, training or assessing the competence of seafarers). The new edition, entitled *STCW 95*, includes the consolidated text of the 1978 Convention and its annex, the STCW Code, the Final Act of the 1995 Conference of Parties to the Convention and the texts of the resolutions adopted by that Conference. The new edition is in loose-leaf format so that it can be revised as the annex or the Code is amended.

Sales No. IMO-938E (1995 edition), £28 (including ring binder). This price includes free surface postage (add £12.00 for airmail).

GMDSS Handbook

(2nd edition, 1995)

The new edition provides up-to-date information on the global maritime distress and safety system (GMDSS) up to May 1995. It is published in two forms, as a new 1995 edition and as separate unbound pages to replace the pages of the 1992 edition.

Sales No. IMO-970E (1995 edition), £60 (including binder); sales No. IMO971E (unbound pages), £40 (without binder). Please add £5 for postage and packing in the UK or £10 for surface mail/£25 for airmail elsewhere.

For further information about the electronic catalogue or to order these or any other IMO publications, please contact the Publications Section, IMO, 4 Albert Embankment, London SE1 7SR, UK. Tel.: +44(0)171 735 7611; Fax: +44(0)171 587 3241.

The world container port market to 2010

This 262 page report by Ocean Shipping Consultants Ltd. provides a comprehensive and wide-ranging appraisal of the development of world container ports and port regions, and presents detailed forecasts of container port throughput, capacity utilization and investment needs to 2010.

After more than two decades of growth, the outlook for container port demand continues to be extremely positive in both the developed and developing countries. In the newly industrialized and developed economies, where containerization is well established, rising world trade, especially in manufactured goods, continues to drive up container port demand.

Container throughput growth will continue to be particularly dynamic in the rapidly expanding economies of East Asia. In the developing and traditional economies, both rising trade and increasing containerization are underpinning port demand.

The new study provides a comprehensive appraisal of the container port industries in the developed markets in Europe/Mediterranean, North America, Japan, Singapore and Australasia, the newly industrializing markets of East Asia, developing markets in the Caribbean, Central and South America, the Middle East, the Indian sub-continent and Africa, and the transitional markets of Eastern Europe.

The World Container Port Market to 2010, price £470 or US$ 825, is obtainable from Study Sales Department, Ocean Shipping Consultants Ltd., Ocean House, 60 Guildford Street, Chertsey, Surrey KT16 9BE, UK. Tel.: +44 193 256 0332. Fax: +44 193 256 7084

Significant ships of 1995

The Royal Institution of Naval Architects has now published the sixth edition of the annual publication *Significant Ships*. The 1995 edition is an essential guide to the very best in ship design and shipbuilding, and is an invaluable technical reference source for all those involved in today's marine industry.

The 51 vessels featured in this volume, most over 100 m in length, cover a cross-section of ship types with each being either representative of its type or singularly significant.

Concise technical descriptions are again given for each vessel followed by a comprehensive table of detailed information; these tables have again been considerably expanded to include information on fire control and extinguishing systems and bridge control and navigation equipment, as well as other important systems on board.

Significant ships featured in this edition include *Oriana* (P&O's purpose-built cruise liner for the British market), *Hanjin Pyeong Taek* (Korea's first membrane LNG tanker), *Isle of Innisfree* (passenger/vehicle ferry for Irish Continental Group) and *Murex* (the first of the new Shell double-hull tankers from Daewoo Shipbuilding).

Significant Ships of 1995 has 124 pages, 51 full-colour illustrations, 51 general arrangement plans, and is priced at £25 (RINA members £22). Copies are obtainable from The Royal Institution of Naval Architects, 10 Upper Belgrave Street, London SW1X 8BQ. Tel.: +44(0)171 235 4622. Fax: +44(0)171 245 6959.

Sell's marine industry buyer's guide

The 1996 edition of *Sell's Marine Industry Buyers' Guide* (previously *Sell's Marine Market International*) is now available in a handy A5 format.

The guide provides in-depth coverage on all aspects of the marine industry, including boat builders, equipment manufacturers, suppliers and wholesalers.

The directory's Company Data Section has around 4,500 entries on companies operating within the marine industry and includes contact details, key staff and information on products and services.

The 1996 edition also features a Buyers' Guide to Boats which lists boat types and manufacturers, and an extended local services section which provides comprehensive coverage throughout the UK. This includes, for example, details of new and used boat sales and boat hire and charter.

A Buyers' Guide to Products and Services also contains information for those involved in building, repairing and reconditioning boats, and this is constantly updated as new products and services enter the market.

Sell's Marine Industry Buyers' Guide 1996 is priced at £48. Copies are obtainable from Miller Freeman Information Services, Riverbank House, Angel Lane, Tonbridge, Kent TN9 1SE.

Containerisation International Yearbook 1996

In her opening comments, editorial director Jane Boyes says that the 14 members of the four mega-groups announced last year presently control nearly one third of the world's shipboard slot capacity. The new agreements will collectively control as much as 50 per cent of capacity on the east/west trades.

The four mega-groups have several common features: the provision of very frequent services through a series of separate loops; deployment of larger container ships; operational coordination extending to cover terminals, feeder services, equipment and inland transport; and continued competition between group members.

To achieve the necessary economies of scale, these alliances have accelerated orders for larger vessels, and the *Yearbook's* "Register of Container Carrying Vessels" suggests a growth of 11.9 per cent in container ship capacity during the period to 1 November 1996. This compares with forecasts of 6-7 per cent growth in maritime containerized trade over the next few years.

Port traffic figures collated for the publication's annual "World Container Port Traffic League" show that 1994 saw a 10 per cent increase in port handling activity compared with the previous 12 months. A total of 125 million TEU was recorded for 1994. Hong Kong, Singapore, Tokyo and Tanjung Priok were among Asian facilities experiencing the largest percentage gains in TEU.

A summary of *Containerisation International's* recent survey of ship-shore container gantries shows that orders for construction during 1995-1996 exceeded all previous records. Indications are, moreover, that production levels may further increase from the present 125 units/year to 150 units/year during 1997-1998.

The *Yearbook* includes updated, comprehensive sections covering container carriers (routes, ports of call, vessels and boxes operated), a unique register of container carrying vessels (listing over 6,000 ships in service and on order), container ship managers and shipbrokers.

Containerisation International Yearbook 1996 is obtainable from Readerlink Subscription Services, Lansdowne Mews, 196 High Street, Tonbridge, Kent TN9 1EF, UK. Tel.: +44 (1732) 770823 Fax: +44 (1732) 361708. Prices: UK–£145, Europe–£165/US$ 290, and rest of the world–£210/US$ 355.

International Safety Guide for Oil Tankers and Terminals (ISGOTT)

Fourth edition

Safety is critical to the well-being and reputation of the tanker industry. The *International Safety Guide for Oil Tankers and Terminals*—ISGOTT as it is now widely known—is the standard reference work on the safe operation of oil tankers and the terminals they serve. To remain current, it needs to keep abreast of changes in vessel design and operating practice and reflect the latest technology.

This fourth edition includes much new guidance on recent developments within the industry. Principal among them is the advent of the double-hull tanker as the standard ship. Double-hull tankers are not new, but hitherto they have been specialized vessels, generally smaller ships and confined to certain trades.

As time passes a growing number of tanker operators will have to familiarize themselves with the special characteristics of double-hull vessels. Therefore this new edition addresses such questions as the possibility of hydrocarbon gas leakage into double-hull spaces and stability in some double-hull designs during simultaneous ballast and cargo handling.

Account has been taken in this revision of the growing awareness of air pollution and the use of vapour return lines to avoid venting all hydrocarbon vapours to the atmosphere, as well as of the potential problems created by over-pressurization or under-pressurization of cargo tanks.

The ship/shore safety check-list has been updated and includes bulk liquid chemicals and bulk liquid gases, and the section on pumprooms has been expanded to include maintenance of electrical equipment, and recommendations regarding ways and means of improving safety. The section on hot work has been much improved and all previous pertinent information pulled into a single section.

For further information contact: Witherby & Co. Ltd., Book Department, 2nd Floor, 32-36 Aylesbury Street, London EC1R 0ET, England. International Tel.: +44 171 251 5341; International Fax: +44 171 251 1296.

J. CALENDAR OF EVENTS

1996 meetings

April

11-13 April 1996—American International Shipbuilding Exposition & Conference, New Orleans, LA.
Information: McNabb Expositions, P.O. Box 418, Rockport, ME 04856; Tel.: (207) 236-6196.

22-25 April 1996—PLANS 96: Position Location & Navigation Symposium, Atlanta, GA.
Information: PLANS 96, P.O. Box 424, Marietta, GA 30061; Tel.: (201) 393-2055.

30 April-2 May 1996—Safety at Sea & Marine Electronics Exhibition & Conference, Brighton, UK.
Information: SASMEX International96, Queensway House, 2 Queensway, Redhill, Surrey RH1 1QS, UK; Tel.: +44 (173) 776 8611.

May

6-9 May 1996—OTC 96: 28th Offshore Technology Conference, Houston, TX.
Information: OTC 96, P.O. Box 833836, Richardson, TX 75083; Tel.: (214) 952-9494.

8-10 May 1996—Open Ocean Aquaculture, Portland, ME.
Information: Rollie Barnaby, University of New Hampshire, Cooperative Extension/Sea Grant, 113 North Rd., Brentwood, NH 03833; Tel.: (603) 679-5616.

9-11 May 1996—17th Duisburg Colloquium in Marine/Ocean Technology, Duisburg, Germany.
Information: Institute of Ship Technology Duisburg, Mercator University Duisburg, Bismarcksstrasse 69, D-47057 Duisburg, Germany; Tel.: +49 (203) 379-2779.

31 May-1 June 1996—International Deep-Ocean Technology Symposium, Los Angeles, CA.
Information: Prof. Jin S. Chung, Chair, Organizing Committee, c/o Colorado School of Mines, Department of Engineering, 1500 Illinois St., Golden, CO 80401; Tel.: (303) 273-3673.

June

4-7 June 1996—International Caspian Oil & Gas Conference, Baku, Azerbaijan.
Information: Spearhead Exhibitions Ltd., Ocean House, 50 Kingston Rd., New Malden, Surrey KT3 3LZ, UK; Tel.: +44 (181) 949 9222.

13-14 June 1996—ICMES 96: Safe & Efficient Ships. New Approaches for Design, Operation & Maintenance, Trondheim, Norway.
Information: The Institute of Marine Engineers, The Memorial Building, 76 Mark Lane, London EC3R 7JN, UK; Tel.: +44 (171) 481-8493.

16-20 June 1996—PACON 96: Pacific Congress on Marine Science & Technology, Honolulu, HI.
Information: PACON International, P.O. Box 11568, Honolulu, HI 96822; Tel.: (808) 956-6163.

17-21 June 1996—International Harbour Exhibition, Antwerp, Belgium.
Information: 8th International Harbour Exhibition, attn: Rita Peys, c/o Ingenierushuis vzw, Desguinlei 2214, B-2018, Antwerp, Belgium; Tel.: 32+ (3) 216 0996.

16-20 June 1996—OMAE.'96: 15th International Conference on Offshore Mechanics and Arctic Engineering.
Venue: International Conference Centre, Florence, Italy.
Organizers: OMAE Division of the American Society of Mechanical Engineers (ASME).
Details: Ms. Daniels Mercati, Snamprogretti SpA, Viale A. De Gasperi 16, 20097 S Donato Milanese, Italy. Tel.: 39 25 203 2712. Fax: 39 25 203 8524.

July

16-17 July 1996—IOS 96: International Ocean Symposium.
Venue: Tokyo International Exhibition Centre.
Organizers: The Nippon Foundation Committee to celebrate the establishment of "Marine Day".
Details: International Ocean Symposium 96 Secretariat, Department of Maritime Affairs, The Nippon Foundation, 8F Senpaku Shinko Building, 1-15-16 Toranomon, Minato-ku, Tokyo 105, Japan, Tel.: 81-3 3502 2409. Fax: 81-3 3508 2437.

September

8-13 September 1996—MARSIM '96: International Conference on Marine Simulation and Ship Manoeuvrability.
Venue: Sheraton Hotel, Copenhagen.
Organizers: Danish Maritime Institute in association with Danish Maritime Authority, Association of Danish Shipbuilders and Danish Shipowners' Association.
Details: Jens U. Römeling, Danish Maritime Institute, Hjortekaersvej 99, DK-2800 Lyngby, Denmark. Tel.: +45 4587 9325. Fax: (+45) 4587 9333.

20-23 September 1996—International Conference on Preventing Collision at Sea.
Venue: Dalian, People's Republic of China.
Organizers: IMO, Dalian Maritime University and the University of Southampton.
Details: P.A. Wilson, Department of Ship Science, University of Southampton, Highfield, Southampton SO17 1BJ, UK. Tel.: +44 170 359 3767. Fax: +44 170 359 3299.

September (continued)

23-26 September 1996—OCEANS 96 MTS/IEEE, Ft. Lauderdale, FL.
Information: Oceans 96 MTS/IEEE, P.O. Box 1331, Piscataway, NJ 08855-1331; Tel.: (908) 562 5362, Fax: (908) 981 0538; e-mail: Oceans '96@ieee.org; World Wide Web Site: http://auvibm1.tamu.edu/oes/

24-26 September 1996—Hydro '96: The Hydrographic Society's 10th International Biennial Symposium.
Venue: De Dolen Congress & Exhibition Centre, Rotterdam.
Organizers: The Society's Benelux Branch.
Details: Ms. P.Y. van den Berg, Hydro '96 Organising Committee, Oceanographic Company of The Netherlands, P.O. Box 7429, 270 IAK Zoetermeer, The Netherlands. Tel.: +31 7942 8316. Fax: +31 7941 5084.

25-27 September 1996, 3rd INFOFISH-AQUATECH International Conference on Aquaculture, Kuala Lumpur, Malaysia.
Information: INFOFISH, P.O. Box 10899, 50728 Kuala Lumpur, Malaysia. Tel.: (603) 291 4466. Fax: (603) 291 16804; E-mail: infish@pc.jaring.my.

October

2-4 October 1996—Deep Foundations Institute Annual Conference & Meeting: Technical Programme—Designing and Constructing Deep Foundations for Extreme Events.
Venue: San Francisco, CA.
Organizers: Deep Foundations Institute.
Details: Richard Short, c/o Harza Consulting Engineers and Scientists, 425 Roland Way, Oakland, California 94621, USA. Fax: (510) 568-2205.

First International EuroGOOS Conference Slated for October

The first international conference on EuroGOOS will be held from 7 to 11 October 1996 in The Hague, Netherlands. The meeting's objectives are said to establish a concerted European approach to the international planning and implementation of GOOS (global ocean observing system); to identify European priorities for operational oceanography to promote the development of scientific, technological and computer systems for operational oceanography; and to assess the economic and social benefits of operational oceanography.

EuroGOOS was founded in December 1994 and consists today of 23 government agencies from 14 countries of the European Union. The international EuroGOOS secretariat is located in Southampton, UK.

GOOS will be used to forecast climate changes, for coastal management, fisheries, shipping and the environmental protection of the sea. It is a common initiative of the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the World Meteorological Organization (WMO), and the United Nations Environment Programme (UNEP).

The conference is being organized by the National Institute for Coastal & Marine Management (RIKZ) and the North Sea Directorate, both departments of the Ministry of Transport, Public Works and Water Management, in cooperation with the Royal Netherlands Meteorological Institute, Delft Hydraulics, Advisory and Research Group on Geo-observation Systems and Services, Electronic Data Systems, Oceanographic Co. of the Netherlands, and the Netherlands Geosciences Foundation. Details are available by contacting Congress Office ASD, P.O. Box 40, 2600 AA Delft, Netherlands; Tel.: +31 (15) 212 0234; e-mail: HCPN-eurosim@tudelft.nl.

17-18 October 1996—Fast Ferry USA '96, Inter-Continental Hotel, Miami, FL.
For further information contact: Giles Clark or Denise Clifford, *Fast Ferry International*, Milroy House, Sayers Lane, Tenterden, Kent TN30 6BW, UK. Tel.: +44 15 8076 6960. Fax: +44 1580 766961. e-mail: info@fastferry.co.uk.

November

5-7 November 1996—Offshore West Africa '96, Okoune Palace Inter-Continental Hotel, Libreville, Gabon.
Information: Offshore West Africa '96, 3050 Post Oak Blvd., Suite 205, Houston, Texas 77056, USA.
Tel.: 1 (713) 621-8833.

5-7 November 1996—GNSS 96: Global Navigation Satellite Systems.
Venue: The Church House Conference Centre, Dean's Yard, Westminster, London.
Organizers: The Royal Institute of Navigation, on behalf of the European Union Group of Institutes of Navigation.
Details: The Director, The Royal Institute of Navigation, 1 Kensington Gore, London SW7 2AT. Tel.: +44(0) 171-5890 5021. Fax: +44 (0) 171 823 8671.

1997 meetings

February

25-27 February 1997—13th Fast Ferry International Conference, Singapore Convention & Exhibition Centre.
Information: Fast Ferry International, Milroy House, Sayers Lane, Tenterden, Kent TN30 6BW, UK. Fax: +44 15 8076 6961.

March

17-19 March 1997—Fourth International Conference Remote Sensing for Marine and Coastal Environments, Technology and Applications, Orlando, FL.
Information: ERIM/Marine Conference, P.O. Box 134001, Ann Arbor, MI 48113-4001, USA. Tel.: 313-994-1200, ext. 3234. Fax: 313-994-5123. e-mail: wallman@crim.org; World Wide Web site:http://www.erim.org/CONF/conf.html.

18-21 March 1997—NAV 97, International Conference on Ship and Marine Research, Naples, Italy.
Contact: Dipartimento de Ingegneria Navale, P.le Tecchio, 80, 80125 NAPOLI, Italy. Tel.: +38 81 7682594, fax: +39 81 7682103, e-mail: din@ds.unina.it.

April

7-10 April 1997—1997 International Oil Spill Conference: 15th Biennal International Conference on the Prevention, Behaviour, Control and Cleanup of Oil Spills, Fort Lauderdale, FL, USA.
Contact: 1997 Oil Spill Conference, Suite 300, 655 15th Street, N.W., Washington, D.C. 20005, USA.

13-16 April 1997—China Fast Ferry & Commercial Craft Show, Shanghai, China.
Information: Proshow, 161 Chelsea Wharf Lots Road, London SW10 0QJ, UK. Tel.: +44(0)171 376 7777; Fax: +44 (0) 171 352 0818.

23-26 April 1997—9th International Marine, Shipping, Port Equipment and Cargo Handling Exhibition, Jakarta, Indonesia.
Contact: Overseas Exhibitions Services Ltd., 11 Manchester Square, London W1M 5AB UK. Tel.: +44 171 4861951, Fax: +44 171 486 8773, E-mail: indo@montnet.com, World Wide Web site: http://www.montnet.com.

May

31 May-6 June 1997—20th World Ports Conference of the International Association of Ports and Harbours.
Venue: Hilton Park Hotel, London
Organizers: Port of London Authority.
Details: Sheila or Terry Hatton, Port of London Authority, Devon House, 58-60 St. Katharine's Way, London E1 9LB. Tel.: +44 (0) 171 265 2656. Fax: +44(0) 171 265 2699.

June

17-19 June 1997—Planning for global radionavigation, 2nd international radionavigation conference and exhibition, Moscow, Russia
Contact: Mrs. Lubov Shachkova, 2, Bolshoy Trekhsvyatitelskiy,(Vuzovskiy)Pereulok,Moscow 109028, Russia. Fax: +7 97 917 0127.

17-19 June 1997—European Workboat Exhibition, Port Solent, Southampton, UK
Contact: National Boat Shows Ltd., Meadlake Place, Thorpe Lea Road, Egham, Surrey TW20 8HE, UK. Tel.: +44 178 447 3377, Fax: +44 178 443 9678.

18-20 June 1997—Water Pollution 97, Modelling, Measuring and Prediction, Bled, Slovenia.
Contact: Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton, SO40 7AA, UK. Fax: +44 170 329 2853, e-mail: wit@wessex.witcmi.ac.uk.

23-25 June 1997—IMDC '97, Sixth International Marine Design Conference, Newcastle upon Tyne, UK.
Contact: Department of Marine Technology, Armstrong Building, the University, Newcastle upon Tyne NE1 7RU, UK, Fax: +44 191 261 1182.

July

7-10 July 1997—8th International Conference on Behaviour of Offshore Structures, BOSS '97, Delft, The Netherlands.
Contact: Congress Office KiVi, P.O. Box 30424, 2500 GK The Hague, The Netherlands. Tel.: 070 391 9890.

September

22-29 September 1997—4th International Marine Biotechnology Conference-IMBC'97, Sorrento, Paestum, Capo Rizzuto, Otranto, Pugnochiuso-Italy
Information: Ms. Donatella Capone, IMBC '97, Stazione Zoologica "Anton Dohrn", Villa Comunale, I-80121 Naples, Italy. Tel.: +39 (0) 81 583 3215. Fax: +39 (0) 81 764 1355. E-mail: imbc@alpha.szn.it.

1998 meetings

May

11-14 May—Conference of the West European Confederation of Maritime Technology Societies (WEMT) "The European shipping and shipbuilding in the global challenge of the next century", Rotterdam, the Netherlands.
Contact: Mrs. Saretha van Driel-Naudé, WEMT, Mathenesserlaan 185, 3014 HA Rotterdam, The Netherlands. Fax: +31 10 4364980.

September

20-25 September—7th International Symposium on Practical Design of Ships & Mobile Units, The Hague, The Netherlands
Contact: MARIN, P.O. Box 28, 6700 AA Wageningen, The Netherlands.

Conference proceedings

20th Annual Seminar of the Center for Oceans Law and Policy

15-16 March 1996—"Implementing the 1982 Law of the Sea Convention", Annapolis, Maryland, USA
Summary: Each year the Center— for Oceans Law and Policy (COLP) of the University of Virginia School of Law hosts a conference of current interest to the oceans community. This year's programme, "Implementing the 1982 Law of the Sea Convention", examined current fisheries issues and developments in ocean science and technology. These topics were examined particularly in light of the recently concluded United Nations Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks and the implementation of the 1982 Convention on the Law of the Sea.

Specific panel titles included:
- Adequacy of basis for stock management

- Recent international fishery agreements
- Implementation and enforcement of international agreements
- Ocean science and technology under the 1982 convention
- International perspectives, continuing ocean conflicts
- New law of the sea institutions

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K. UNIDO NEWS

Establishment of the Mediterranean Centre for Marine Industries in Greece

In spite of the considerable efforts taking place in industrializing countries in scientific research and technology development, the industrial gap between the North and the South continues to widen. The marine sector has significant potential for the South. However, the development of this industry lags behind in terms of access to competitive technology and investment capital. The marine industry and its related technology services is an important economic factor for the Mediterranean region.

Facing this challenge, the United National Industrial Development Organization (UNIDO), in cooperation with the Government of Greece (General Secretariat of Research and Technology, Ministry of Industry, Energy and Technology), is now promoting the establishment of a Mediterranean Centre for Marine Industries located in Greece aiming at stimulating the advancement of the marine industries sector in the Mediterranean region, with particular emphasis on North-South cooperation.

Mission statement

The mission of the Mediterranean Centre for Marine Industries is to primarily promote strategic partnerships among Mediterranean countries in marine technology development and commercialization leading to enterprise cooperation between developing and developed countries in the region.

Objectives and functions

The Centre will undertake activities related to the identification, evaluation and promotion of business development projects. It will assist in the initial phases of joint projects through provision of such services as technology and market assessment, strategy development and project management.

Aiming at increasing industrial activities in the marine sector, the Centre will provide a variety of benefits to its participants, including:

- Acting as a bridge for the transfer of marine technology, encouraging international cooperation and eliminating duplication of efforts;
- Providing information relating to national priorities and business environments, technology and market opportunities, potential partners, funding mechanisms, etc.;
- Improving access to new markets and technologies through promotion of strategic alliances and joint projects between enterprises;
- Promoting the pooling of technology development resources, resulting in an enhanced technology base, shared risks and reduced technology development costs;
- Provision of a linkage to regional or subregional R&D programmes with implications for the marine industry.

Work programme

The Centre will be responsible for developing a work programme in accordance with its objectives and the priorities of the participating countries. The core activities of the programme are anticipated to cover:

- Establishment and management of an industrial North-South network, providing a clearing-house function for the creation of joint enterprises;
- Identification, screening and promotion of commercially oriented projects in selected priority areas;
- Project management and technical services supporting the initial phase of joint project operations;
- Centre and programme administration.

It is considered essential that the programme places priority on projects having regional importance and for market opportunities in the marine industrial sector. The initial priority areas will be established following consultations. These will include solar desalination, marine environmental measurements and aquaculture at the present time.

Initial consultation missions have recently been undertaken by representatives from UNIDO and the Greek authorities to Malta, Egypt, Israel and Lebanon. The response from these countries was extremely positive. In outlining the proposed Centre, it was stressed that the Centre will be a network with a coordination unit, rather than a central unit involving a number of employees and producing its own research and technological applications. The coordinating unit will be in close contact with focal points in each of the participating countries thus facilitating a flow of information so as to be able to bring interested parties together in the various fields of activities.

During the meetings held, priority topics were identified by the countries visited. These could include: vessel traffic services (VTS); mariculture; exploitation of mineral resources with the ensuing negative effects; coastal zone management; port development; shipbuilding/ship-repair; and environmental considerations. Focal points were discussed and possible partners identified. It is anticipated that the feasibility study will be available by the end of the year.

Further information

Further information on the proposed Mediterranean Centre for Marine Industries can be obtained from:

UNIDO:
A. Bromley
Programme Coordinator
Technology Services
Investment and Technology Promotion Division
P.O. Box 300, A-1400 Vienna, Austria
Tel.: (+43) 1 21131 5158
Fax: (+43) 1 21131 6809

GREECE:
P. Stolakis
Martedec S.A.
16, 2nd Merarchias Str.
185 35 Piraeus
Greece
Tel.: (+301) 452 6561-2
Fax: (+301) 453 5588

TECHNOLOGY AND INVESTMENT OPPORTUNITIES

TECHNOLOGY REQUESTS

SALT WATER PRAWN FARMING

Company wishes to start a new project to produce packaged products from prawns farmed in seawater. Technology and know-how required, including processing, storage and transportation of the prawns. 90% of the product will be for export markets.
Estimated project cost: US$800,000.
Specification of Technology Requirement: Product and process know-how, maintenance, packaging, training, technical services, equipment, quality standards and environmental considerations.
Preferred Mode of Cooperation: Equipment supply and technical services.
CONTACT: Mr. Bonny L. Mwaipopo, Managing Director, Lembuka Products Ltd., P.O.Box 32690, Dar-es-Salaam, Tanzania. Tel: +255 51 27509

PISICULTURE IN HOT WATER

Technology for eel pisiculture in hot water is sought by private entrepreneur. The technology should be suitable for approximately 100m^3 of hot water which can be heated at 26^{0}C throughout the year.
Preferred Mode of Cooperation: Joint venture, designs, formulation and/or technical assistance.
CONTACT: Ref. 5.6, Slovak Chamber of Commerce & Industry, Regional Chamber Trencin, Dolny Sianec 1, 91101 Trencin, Slovakia. FAX: +42 831 521 023.

BRIDGE MANUFACTURING

Manufacturer of equipment for construction of major bridges wish to expand and modernize plant. Plans are to manufacture bridges with spans varying from 15m to 40 m, precasted jointed piles of 275mm x 275mm with section length varying from 6m to 12m, together with casting yard equipment to match. Raw materials are available locally.
Preferred Mode of Cooperation: Financial assistance with buy-back arrangement.
CONTACT: Mr. Jitender Gupta, Sudha Exports, P.O.Box 9233, Delhi 110 092, India. FAX: +91 11 222 2339.

PROCESSING OF MARINE PRODUCTS

Company wishes to expand and modernize production of processing of shrimps, squid and cuttle fish. Company at present using Individual Quick Freezing technology.
Estimated project cost: US$1.70 million.
Preferred Mode of Cooperation: Joint Venture, Licensing, Buy-back agreement, or equipment purchase.
Company: Koluthara Exports Ltd., Kerala, India.
CONTACT: REF: IND-KE/013/V/96-11
The Country Director, UNIDO, Investment & Technology Promotion Initiative (ITPI), 149 Jor Bagh, New Delhi 110 003, India. FAX: +91 11 460 3315. E-mail: unido@undp.ernet.in

FISHING VESSELS - SASHIMI TUNA

Company wishes to establish a joint venture for fishing in waters around Fiji, or to hire longline fishing vessels. Further, to establish commercial ventures specializing in sashimi tuna.
CONTACT: Swift Trading Ltd., P.O.Box 15184, Suva, Fiji Islands. FAX: + 679 361 155.

FOR MORE TECHNOLOGY REQUESTS AND OFFERS, VISIT UNIDO's HOME PAGE: HTTP://WWW.UNIDO.ORG

TECHNOLOGY OFFERS

WIND PUMPS

Company offers proven design of low-cost wind-pumps (water pumping windmills). It offers high standards of reliability and robustness, easy installation, automatic storm protection with minimal maintenance. Suitable for pumping heads up to 90 metres. Technology is offered for manufacturing under licence.
CONTACT: Mr. T.A. Polak, 43 Downing Street, Farnham, GU9 7PH, Surrey, Untied Kingdom. FAX: +44 1252 737 106.

CORROSION PREVENTION

Company offers technology for improving corrosion prevention of ferrous metals. The technology is based on the creation of phosphate and oxide coverings, ensuring surface preparation before and after phosphating and blackening. Offer include technological equipment.
CONTACT: REF: 6.69, Slovak Chamber of Commerce & Industry, Regional Chamber Trencin, Dolny Sianec 1, 911 01 Trencin, Slovakia. FAX: +42 831 521 023.

SPILLED OIL ABSORBENT

Institute offers new absorbent for clearing up oil spilled on water surface. Absorbs up to 40 -80 times its own weight, in seconds, regeneration ability is roughly 200 times that of sorption-press. Absorbent can clean 99% of oil from water surface under weak wave conditions, expenses are low.
Offer includes: technical know-how, production technology and applications.
CONTACT: Mr. Le Ngoc Khanh, Ho Chi Minh City Institute of Chemical Technology, 1 Mac Dinh Chi Dist. Ho Chi Minh City, Viet Nam. FAX: +84 8 829 5889.

AQUACULTURE PLANTS

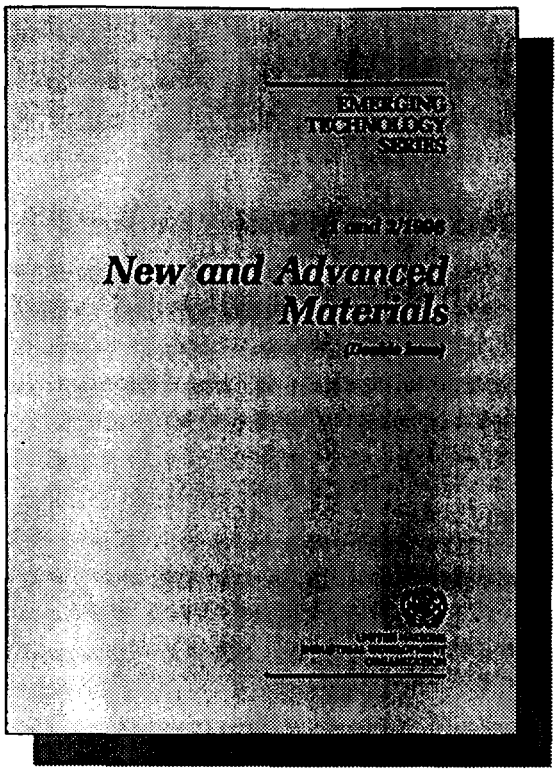
Company offers know-how, management, marketing and innovative technology for establishing aquaculture plants offshore. All projects include feasibility studies relating to the biological and pathological suitability of the chosen site and suitable equipment.
CONTACT: Mr. Alessandro Rizzotti, SEATEC Engineering Ltd., Via Domenichino 19, 20145 Milan, Italy. FAX: +39 992 498 6627.

FLEET POSITION INFORMATION SYSTEM

Company offers know-how for a mobile information system which is very flexible using a record and playback approach to store and display vessel position information. The system (Ci2) can use both vector and raster image overlays as required. System consists of 2 modules: front-end and back-end software; the positioning and radio transmission subsystems. Use of an onshore supplementary system to improve accuracy is possible. System developed using information from space-based positioning systems such as GPS and GLONASS.
CONTACT: Product Manager Navigation, Infonav Corp. 50 Harbour Road, P.O.Box 188, Station A, St. John's NF A1C 5J2, Canada. FAX: + 709 754 0705. E-mail: infornav@aol.ca

FOR MORE TECHNOLOGY OFFERS AND REQUESTS, VISIT UNIDO'S HOME PAGE ON THE INTERNET:

HTTP://WWW.UNIDO.ORG



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Fax: (+43) 1-21131-6843, E-mail: jroetzer-sweetland@unido.org

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CONTACT US NOW FOR MORE INFORMATION: Ms. J. Roetzer-Sweetland, UNIDO, Industrial Information Section, Vienna International Centre, P.O.Box 300, A-1400 Vienna, Austria. FAX: +43 1 21131 6843. E-mail: jroetzer-sweetland@unido.org

Establishment of the International Materials Assessment and Application Centre (IMAAC)

The establishment of the ***International Materials Assessment and Application Centre (IMAAC)*** is part of an extensive programme of the Investment & Technology Promotion Division of UNIDO aimed at establishing and facilitating networking between international technology centres in the field of new technologies.

It is acknowledged world-wide that materials technology is a key which enables technology for a wide range of industrial sectors and can have a major impact on the economic and industrial competitiveness of a country. The further development and support of new materials are so important precisely because very sizeable impetus and spill-over effects on virtually all sectors of the processing industry can result from them.

The problem confronting industrialization and economic development strategies in the late 1990s and beyond, will be how developing countries can absorb and utilize the new scientific and engineering insights and practices so as to upgrade their traditional and existing materials capabilities to meet higher specifications and quality requirements in users national, regional and global markets.

The speed of technological change, the enormous complexity and multi-disciplinary, trans-sectoral aspects of materials science and engineering clearly highlight that not only are we living in an 'information age', but are entering a 'materials science age', upon which information technologies, including telecommunications, micro-electronics and biotechnology find themselves heavily dependent.

In this context, the IMAAC is expected to raise the level of understanding throughout the materials-related industry, on the importance of materials transition and to help developing countries mobilize the necessary resources for sustainable development and competitiveness. The Centre will provide an international forum for managing specific techno-economic aspects of materials science and engineering in an integrated, multi--disciplinary and trans-sectoral manner.

UNIDO is starting the implementation of the pilot activities of the IMAAC project, which aims to set out the basis for its full operation and functioning. The Republic of Brazil, under a Trust Fund Agreement with UNIDO, has provided IMAAC with its initial funding and will host the Centre in Rio de Janeiro.

For more information, contact: Managing Director, Investment & Technology Promotion Division, UNIDO, P.O.Box 300, A-1400 Vienna, Austria. FAX: + 43 1 21131 6809. E-mail: vkojarnovitch@unido.org

UNIDO AND NIMTECH (UK)

LAUNCH INVESTMENT PARTNERSHIP SCHEME

Following the signing of an agreement to provide support for British firms, a window of opportunity for British investment and technology has been opened.

At the official launch, NIMTECH's Chief Executive Officer said that the two-year project would "give UK firms a head start, enabling them to capitalize on new overseas business opportunities generated by UNIDO technical cooperation projects, which amounted to more than US$100 million in 1996."

UNIDO's representative said that the project represented a major step towards helping private firms in developing countries meet new business partners in the United Kingdom.

The project builds on the success of an initial 12-month cooperative agreement between UNIDO and NIMTECH, begun last year to promote British partnerships in investment and technology in developing countries and economies in transition. It aims to sharpen the focus of commercialization of new and emerging technologies for which viable markets - estimated to be worth more than US$1,000 million - have been identified. Emphasis so far has been on cleaner production techniques, biotechnology and nanotechnology.

UNIDO is the specialist United Nations agency that promotes sustainable industrial development in countries with developing and transition economies. It harnesses the forces of government and the private sector to foster competitive industrial production, develop international industrial partnerships and promote socially equitable and environmentally sustainable industrialization.

For more information, contact: Stuart Heaman-Dunn, Investment & Technology Promotion Division, UNIDO, P.O.Box 300, A-1400 Vienna, Austria. Fax: + 43 1 21131 6809; E-mail: sheaman-dunn@unido.org . OR Paul Richardson, NIMTECH, Alexandra House, Borough Road, St. Helens, Merseyside, WA10 3TN, United Kingdom. Fax: + 44 1744 453 377; E-mail: helpdesk@nimtech.co.uk .

Information Resource Management System IRMS

A NEW SPECIALIZED SYSTEM FOR INDUSTRY MANAGERS

Developed originally and tested with UNIDO's network of national Industrial and Technological Information Bank (INTIB) focal points in developing countries, the Information Resource Management System (IRMS) is a specialized system that focuses on a wide variety of data and how industry managers use them. The IRMS is now available as an integrated information processing package.

The software basis of IRMS is UNESCO's Micro-ISIS with additional Pascal programmes for user friendliness. Menu driven and featuring pop-up/pull-down sub-menu, the system enables data entry and editing, browsing, searching, display, printing and network functions such as data import and export. A special formatting language allows data to be prepared in a form usable by other software packages.

IRMS can be tailored to individual needs, particularly decentralized networks. For example, the same basic package may supply the name of a pollution control expert at one location, record real-time data for materials balances on a manufacturing process at another, and supply information sources on technological development in aluminium can recycling at another. With the aid of a mailing sub-system, IRMS can also be used to record and index business information such as addresses, phone and fax numbers, etc., and to support office procedures.

Designed for IBM-compatible PCs (386 and above), IRMS comes as a set comprising an installation diskette, user's manual, field specification handbook and a questionnaire for data collection.

Price: US$ 100.-, plus postage and packing

For further information, please contact:

Ms. Shadia Bakhait, Industrial Information Section (ITPD), UNIDO, P.O. Box 300, A-1400 Vienna, Austria. Tel: (43-1) 21131 3893, Fax: (43-1) 21131 6809, E-mail: sbakhait@unido.org

The IRS: The International Referral System of UNIDO

One of the latest tools added to INTIB (Information and Networking for Technology, Investment and Business) is the ***International Referral System (IRS)***. IRS is an information professional referral service that serves a wide range of information needs: from document delivery to on-line research; from market surveys to industrial/technical expertise; and business opportunities.

The IRS operates by matching our clients, mainly entrepreneurs from developing countries, who have industry-related questions with members of the service, professionals or institutions throughout the world, who can provide state-of-the art, tailor made answers to their questions. To use this service, clients are requested to complete a questionnaire which assists in the formulation of the query so that the best matches will be found among the service members. All members of the IRS have substantial industrial development experience.

The IRS thus offers our clients a means to identify the best world-wide industrial information provider for a specific question, at conditions affordable by developing country entrepreneurs. It further offers its members a valuable new source of business with developing countries, whilst guaranteeing their independence.

IRS members are divided into two groups: *Specialized Information Sources (SIS)* and *Investment Facilitators (IF)*. SIS consists of information professionals whose activities focus on providing information products to industrialists wishing to solve their daily production problems or to develop new production facilities. Ifs are mainly institutions promoting services related to the financing or cooperation aspects of industrial activities.

The members of the IRS are available in printed form by ordering the ***World Directory of Industrial Technology and Investment Support Services (ID/402).*** The Directory contains two chapters: the first is concerned with investment facilitators, numbering 75 in 57 countries, with a 15 services cross-reference list. The second is concerned with information sources, numbering 169 information providers in 43 countries, with 34 industrial sectors and 19 activities cross-reference lists. Both chapters are organized to provide profiles of each organization, sorted alphabetically by country and by organization name.

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