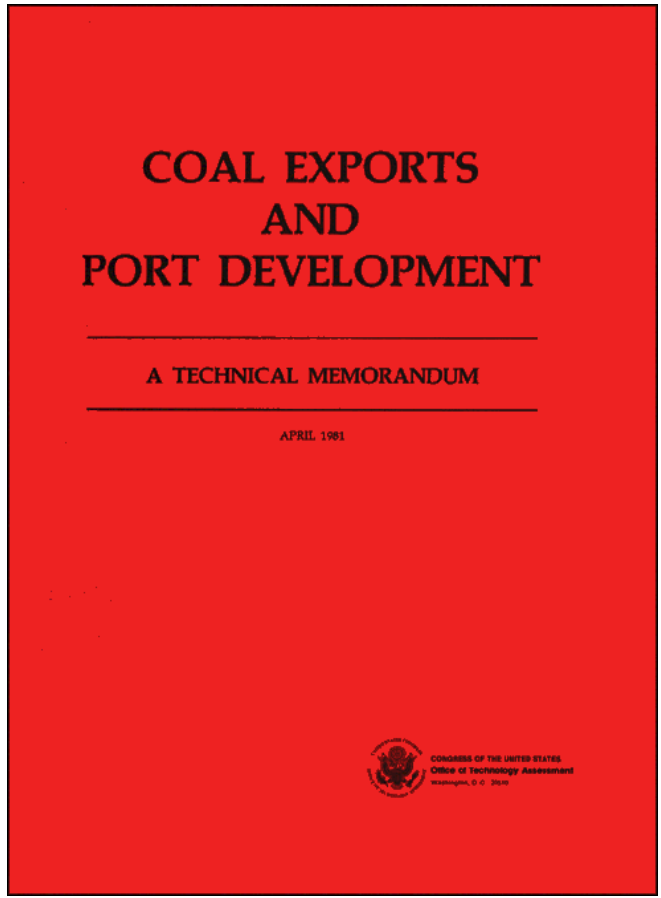
Coal Exports and Port Development

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Preface

The Office of Technology Assessment has previously published reports on the subject of domestic coal production and use; it has prepared other assessments on marine transportation issues. Recognizing this background and the urgency of coal export issues now before Congress, Sen. Charles McC. Mathias, Jr., a member of the Technology Assessment Board, asked OTA to prepare an analysis of Federal policies affecting coal exports and port development. He asked that this analysis be a short-term effort of limited scope, focusing on major current issues of congressional concern since new legislation had been introduced and several hearings on the topic are pending.

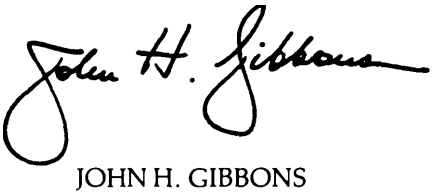
The technical memorandum, prepared in response to that request, addresses four major issues which are important to Federal policy debates now before Congress:

- estimating the potential U.S. coal export market;
- development of foreign trade policy;
- the Federal role in dredging harbors; and
- the outlook for alternative technologies.

This analysis indicates that sizable increases in future U.S. coal exports are achievable if the Federal Government and the private sector complement the efforts of each in encouraging these exports and if present trends are not drastically altered by developments in other exporting and importing countries. Without a coherent, positive policy, the United States could lose a substantial share of the future coal export market.

In part, the development of adequate and efficient U.S. port capabilities to handle future exports depends on Federal dredging policies. OTA's analysis suggests general agreement about the case for some changes in current Federal dredging practices, particularly as they relate to allocating some of the costs to the beneficiaries of dredging.

Although the outlook for alternative or new technologies to transport export coal is promising, it does not appear that there is a direct role for the Federal Government in the development of these technologies. However, it is important that an understanding and analysis of the various alternative and new technologies should be a basic element of Federal policy consideration on future coal exports.



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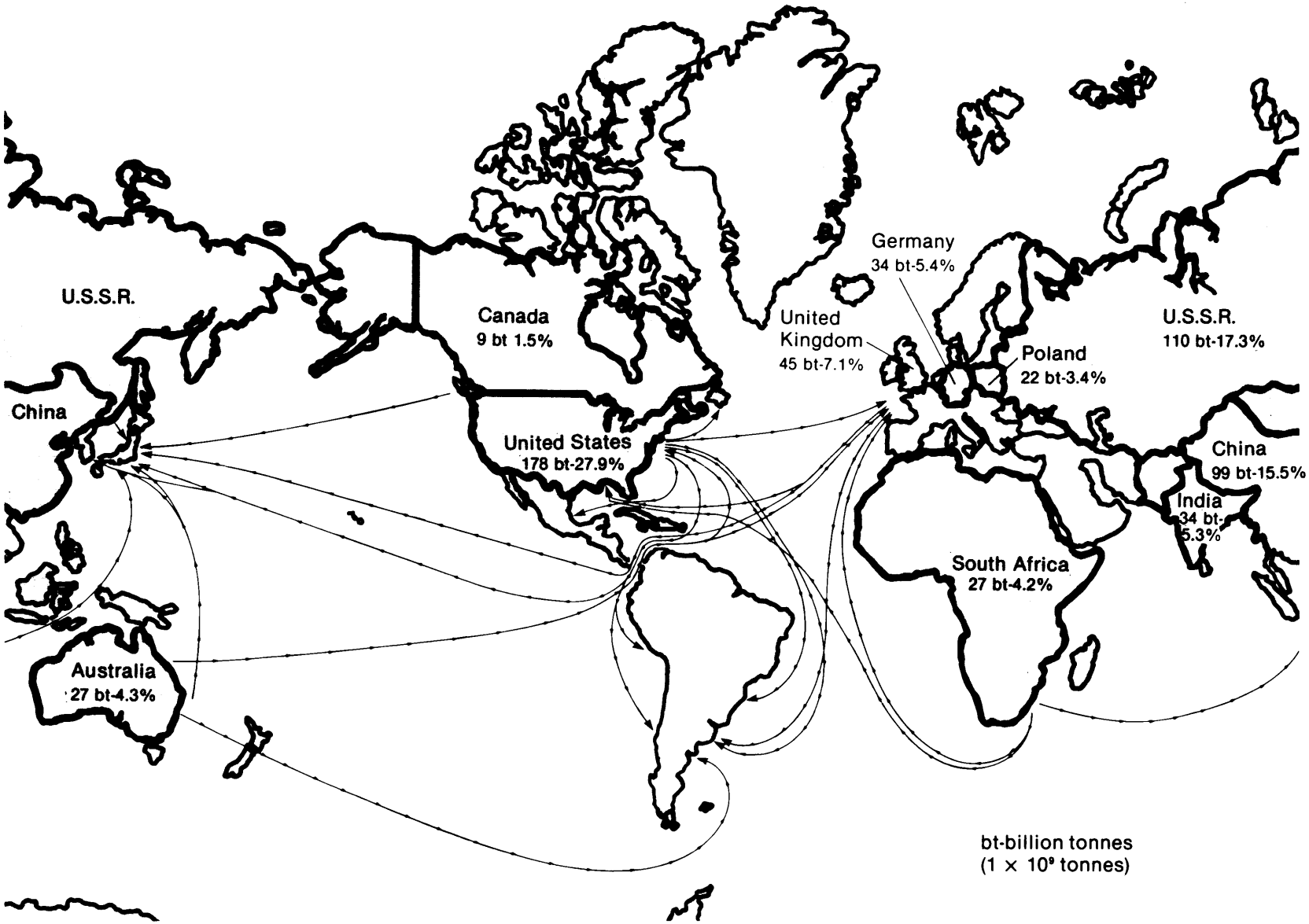
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Chapter 1

Summary

World Coal-Recoverable Reserves and Ocean Trade Routes



Chapter 1

Summary

Long lines of foreign-flag colliers congregating in Chesapeake Bay to await their turn at overtaxed loading facilities in the Ports of Baltimore and Hampton Roads are dramatic evidence of the current boom in U.S. coal exports. Since early 1980, the number of ships queued up at each of these two major coal terminals has reached 100 or more, with a waiting time of up to 2 months before loading.

The recent surge in U.S. exports is due primarily to disruptions in production experienced by two of the other primary suppliers of coal to Europe and Japan—Poland and Australia. Mines in both countries have been shut down by extended strikes, forcing coal-consuming nations to obtain supplies elsewhere, principally in the United States.



Photo Credit: Office of Technology Assessment.

Ships lined up below the Chesapeake Bay Bridge waiting to enter the Port of Baltimore, Md.

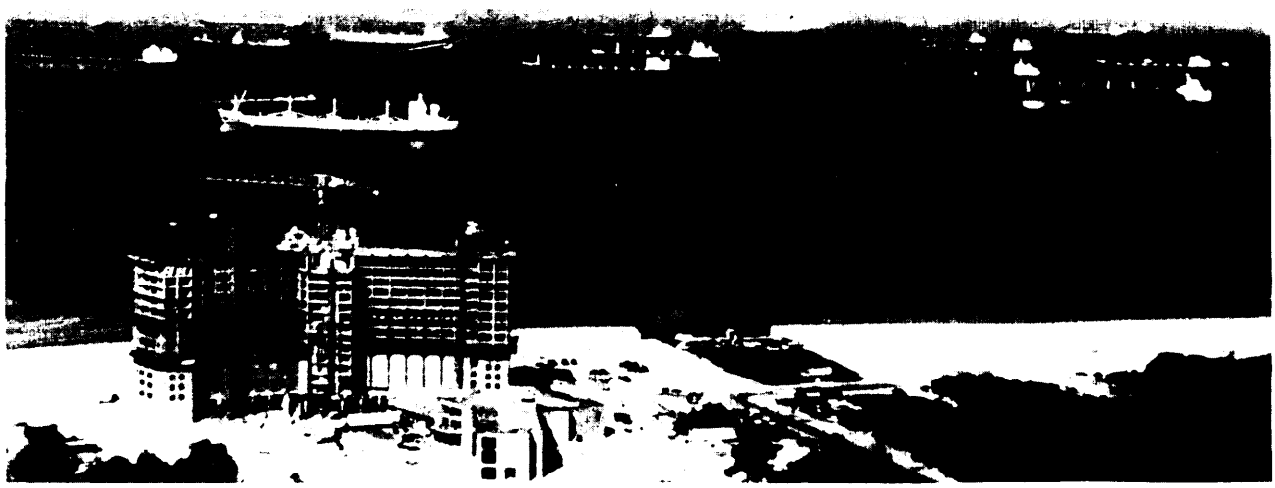


Photo Credit U S. Army Corps of Engineers.

Ship traffic backed up at Hampton Roads, Va.

The new demand for U.S. coal helped push total exports to a record 90 million tonnes (mmt) in 1980–a 39-percent leap over 1979. It also has touched off a major expansion of U.S. coal port facilities to reduce the present congestion and to handle anticipated growth, which some project to be as high as 255 mmt by the year 2000.

One factor contributing to expectations of a large future demand abroad is the recent increase in the number of utilities which are converting electric generating plants from oil to lower cost steam coal. This conversion is occurring among industrial nations, seeking to reduce their dependence on oil supplies from the politically unstable Middle East, and their exposure to spiraling oil prices.

A higher demand for metallurgical coal, which is used in the steelmaking process, also contributed to the 1980 U.S. export total. However, demand for this commodity is expected to remain relatively constant over the next several years.

Over the next two decades, it is widely anticipated that the foreign and domestic shift to steam coal will accelerate because recoverable coal reserves are many times greater than oil and gas and able to meet increasing energy demands far into the future. At present, coal is supplying approximately 25 percent of the world's energy needs. The Massachusetts Institute of Technology's (MIT) World Coal Study estimates coal will have to supply one-half to two-thirds of the additional energy required by the world over the next 20 years,

The United States and other nations have been encouraging both industrialized and less developed countries to put greater reliance on coal for their energy requirements. This stems in part from a 1978 International Energy Agency review recommending the wholesale substitution of coal for oil. The Agency's report concluded that in order to bring this about through immensely expanded world trade in coal, it would be necessary for coal-producing and importing nations to adopt policies facilitating coal development and usage.

Following up on this recommendation, the heads of state of the United States, Canada, Federal Republic of Germany, France, Italy, Japan, and the United Kingdom conferred at their economic summit meeting in Tokyo in June 1979. They pledged to increase as far as possible coal use, production, and trade without damage to the environment.

A year later, this pledge was strengthened at the Venice economic summit meeting. The seven nations pledged to double coal production and use by 1990 and take other steps to increase coal trade and utilization.

During the spring of 1980, the previous administration formed the Interagency Coal Export (ICE) Task Force to study world coal supply and demand projections and make recommendations to guide U.S. export policy and overall international efforts.

This technical memorandum relates to policy issues confronting the Federal Government that relate to the expansion of U.S. coal exports in the near term and the prospects for continued growth over the coming decades. This OTA analysis explores four major issues which may be summarized as follows:

- How realistic are projections that world demand for coal can induce U.S. exports to grow from the present 90 mmt level to 255 mmt annually by 2000? What are the constraints on growth?
- Is there a requirement for Federal involvement at the foreign policy level to promote long-term commitments from purchaser nations, and to provide assurance of stability of price and supply, to attain coal export goals?
- What are the alternatives to the traditional Federal role in dredging harbors so they may be deepened to accommodate larger coal-carrying ships?
- What alternative technologies for coal handling and transport may-be available to enhance the capabilities and efficiency of future exports?

The analysis of these issues has drawn on a number of recent studies. A discussion of the first three issues is found in chapter 2 and a discussion of the fourth is in chapter 3.

ESTIMATING THE POTENTIAL U.S. EXPORT MARKET

In a report issued January 20, 1981, the ICE Task Force projected world trade by 2000 of some 500 mmt of steam coal. The ICE estimated the U.S. share of the steam coal total would be about 200 mmt, or 40 percent, assuming that U.S. suppliers would be able to keep their prices in a competitive range with other exporters and that foreign buyers would find the United States a dependable source of coal. Several experts have told OTA that world trade of 174 mmt of metallurgical coal will remain roughly constant through 2000. The U.S. share of the export metallurgical coal market should remain near 55 mmt annually.

The National Coal Association estimates roughly parallel those of ICE. It expects total coal export volume to grow to 142 mmt by 1990, as compared to the ICE estimate (with metallurgical coal added), of 120 mmt. The combination of the switch to coal by industrial nations and new demand for U.S. coal are real. U.S. coal export forecast of 255 mmt, * by 2000 is achievable (see figure 1)—but probably only if both the Federal Government and private industry work closely together to encourage these exports, and if present trends are not drastically altered by developments in other exporting and importing countries.

Two dominant factors will affect growth in U.S. coal exports: price and security of supply. Currently, U.S. prices for coal delivered in Europe and Japan are 20- to 30-percent higher than Australian and South African coal. (See table 1.) Some of this differential is likely to remain as a result of such factors as higher labor costs, longer distances from mines to ports, and longer transportation routes from the United States to some overseas markets. The differential could be reduced if the United States developed more modern and efficient ports, harbors, and shipping systems.

There is a possibility of more competition. Canadian exports, not presently a significant factor, could grow in the future. Other countries that could enter the field and perhaps widen the present U.S. price differential, include Colombia, Indonesia, and the People's Republic of China.

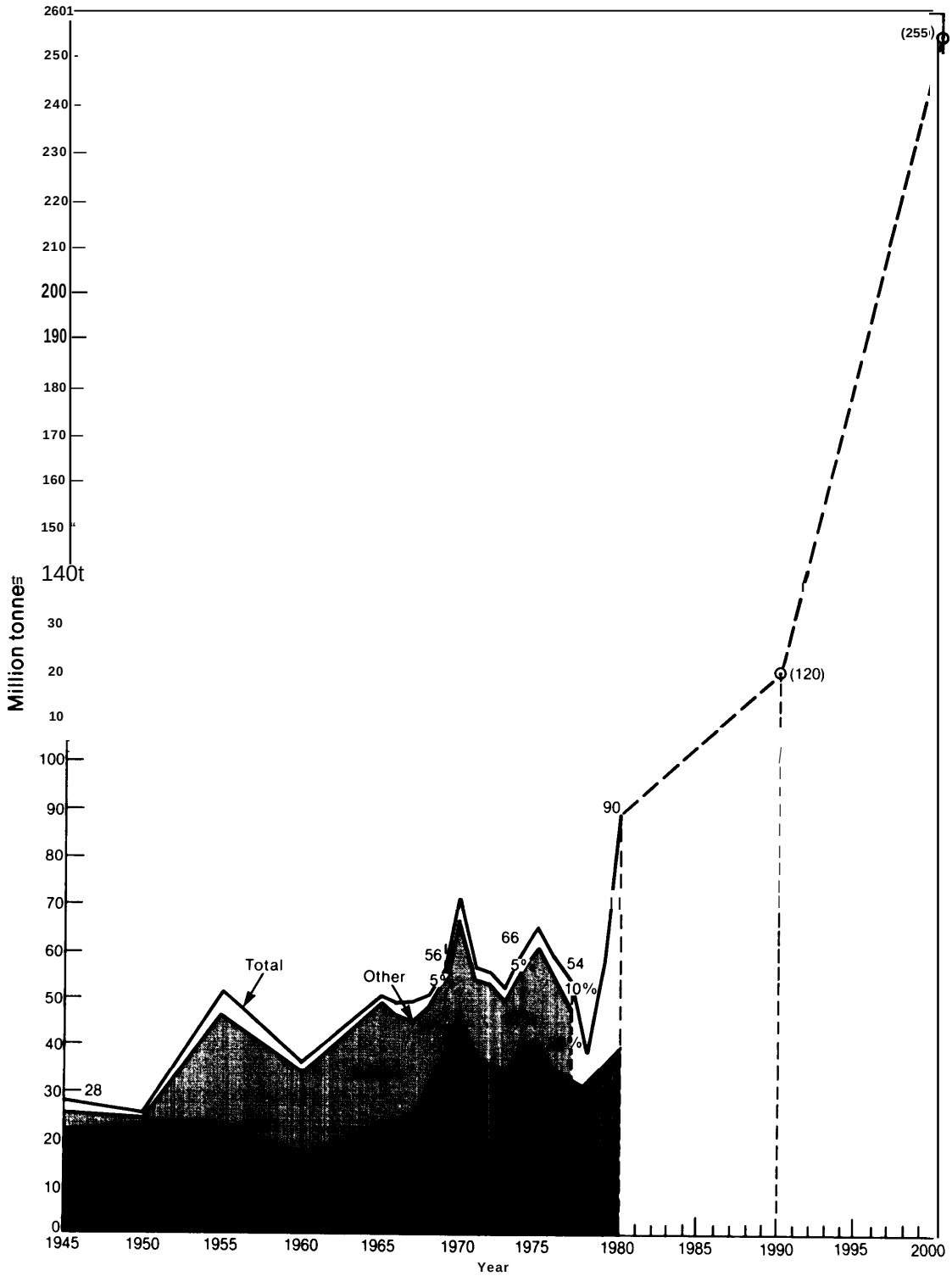
European nations and Japan are concerned about maintaining the reliability of their supplies as they become more dependent on coal. One of their criteria for making purchases on a long-term basis is the susceptibility to interruption of exports from a given country. Importers also are interested in fostering a diversity of suppliers in order to cope with interruptions and to stimulate competition.

The U.S. share of the world market depends partly on the potential or real difficulties being experienced by competitor nations. South Africa is subject to boycotts by some importing nations because of its racial policies. Australia could experience a recurrence of the 1980 labor difficulties which reduced production. Poland, even if its labor unrest is quieted, still must cope with the fact that its coal reserves are not as abundant or easily mined as those of other countries. Polish exports to Western Europe may be further restricted by the need to meet domestic requirements and demand for coal from other Soviet bloc nations.

In sum, there are many uncertainties in estimating the potential U.S. share of the world steam-coal market over the next 20 years. However, one thing does become evident from this OTA analysis. If the United States does not develop and pursue a coherent, positive policy on coal exports, it runs the risk of losing a large share of the market to other coal-producing nations.

● This figure is based on the ICE estimated of 200 mmt of steam coal and adding 55 mmt of metallurgical coal.

Figure 1 .—History and Projection of U.S. Coal Exports



Note: Steam coal at 30 percent of total in 1980 is expected to grow to 78 percent by 2000.

SOURCES: History-Coal data book. Projection-ICE Task Force with constant 1960 metallurgical coal added.

Table 1.—Selected Current International Steam Coal and Shipping Prices (averaged, U.S. 1981 dollars/tonne)

	Price FOB port	Ocean freight[a]	Delivered price	$/MBtu
U.S. east coast to NW Europe	$50	$18	$68	$2.60
Poland to West Europe	54	8	62	2.45
South Africa to Europe	43	13	56	2.05
Australia to Europe	44	26	70	2.66
U.S. east coast to Japan	50	28	78	2.95
South Africa to Japan	43	22	68	2.49
Australia to Japan	44	16	60	2.28

[a]This freight cost does not include additions of $6 to $10/tonne now charged as demurrage for those ships waiting to load at Baltlmore and Hampton Roads

SOURCE: *Coal* Week International, Mar 18 and 25, 1981

FOREIGN TRADE POLICY CONSIDERATIONS

Principally because of its abundant coal supplies and overall political stability, the United States is viewed as an attractive trading partner by many coal-importing nations. However, it does not appear that these factors alone will assure that the United States will capture a major share of the world steam coal market in the years ahead. Coal trading partners are concerned about a number of factors in dealing with the United States including:

- The absence of an articulated coal export policy by the new administration. (It is not yet clear whether coal export initiatives started and/or suggested during the previous administration will be carried forward by the present one.)
- The possibility of future coal industry strikes. A major strike by the United Mine Workers would have a serious impact on potential coal export contracts.
- Lack of east coast deep-draft harbors to accommodate larger and more competitive coal carriers. Because larger vessels are expected to take over much of the world coal trade in this decade, U.S. exports will be at a disadvantage if these ships cannot be accommodated in U.S. harbors.
- Limitations on present U.S. port and ship-handling capacity, loading facilities, and high costs of mine-to-port transportation.

The coal-importing nations are sensitive to official U.S. policies which affect priorities for exports. E.g., a law passed by the 96th Congress allows domestic coal ships supplying New England and other sections of the country to be loaded at U.S. terminals ahead of foreign ships. So far the effect of the law appears to be slight but it has great symbolic importance to foreign buyers.

Foreign buyers also are mindful of how the Federal Government has occasionally intervened in the sale of various commodities to other countries—notably grain to the Soviet Union and soybeans to Japan. They want guarantees of noninterference with coal exports. Recent U.S. statements on coal guarantees have been general in nature and contain language stating the United States will honor commitments except in cases of national emergency—exactly when foreign buyers might need coal the most.

No explicit Government-backed *guarantees* for coal exports are now in effect. Coal sales are conducted by private corporations; the Federal Government cannot enforce contract compliance.

The ICE Task Force and others have suggested a number of specific mechanisms to enhance trade with other nations. These include:

- creation of a special Federal office to monitor the development of the U.S. coal trade;
- establishment of bilateral and multilateral consultations with major coal trade partners to exchange technical and other information and improve contacts with the U.S. coal industry;
- establishment of a permanent U.S. inter-

national coal trade delegation to act as a catalyst in the completion of new coal transactions and aid the implementation of existing ones; and
- formation of a U.S. Coal Export Trade Association, which would include producers and other elements of the domestic industry, to represent their international interest.

These proposals are only initial examples of a range of Federal policy initiatives which could be pursued. However, if the administration and Congress wish to promote U.S. exports of coal, an important step would be to reaffirm the U.S. commitment to increase domestic coal production, improve the necessary infrastructure, and increase-exports. This would establish a political climate that would be reassuring to importing nations in assessing the reliability of the United States as a future coal trade partner.

DREDGING: THE FEDERAL ROLE

Within the coal industry there is widespread agreement that the United States export market will not expand to its full potential unless harbors are deepened to permit the entry of the new generation of very large colliers now coming into service. The reason: much of the flexibility in steam coal prices lies in ocean transportation costs. Dredging proponents claim that the costs could be significantly reduced by deepening channels to handle larger ships, however, they do not include the cost of dredging in many of their arguments.

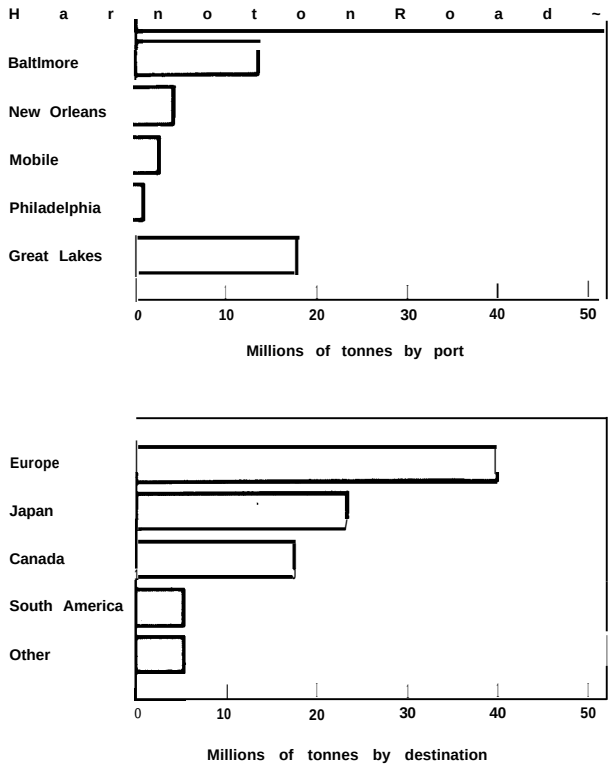
New colliers of 150,000 tonnes are expected to offer a 30- to 50-percent transportation cost advantage over older 60,000-tonne ships now transporting U.S. coal to Europe. None of the major U.S. coal ports can now fully load ships over *80,000* tonnes, and larger ships now entering these ports must depart with a partial load. Newer ships are tending toward the larger sizes because most of the rest of the world's major coal ports are deep-draft. Coal now represents about 10 percent of the total import and export tonnage through all U.S. ports. Therefore, while modern deep harbors would assist the coal trade at selected ports, it would also assist future trade in numerous other commodities carried on deep-draft ships.

Under an arrangement dating from the early 1800's, the U.S. Army Corps of Engineers has responsibility for maintaining the Nations's waterways and harbors, including dredging. In a lengthy, multistage process, dredging projects are studied by the Corps and authorized and funded by Congress on a case-by-case basis. Many parties have urged that a reexamination be made of the Federal role in dredging harbors and the process by which dredging projects are initiated and carried out.

Federal spending for dredging projects is under scrutiny by the administration and Congress, and several proposals have been put forward for sharing dredging costs with local and private entities benefiting from deepened harbors. The sums involved in dredging are substantial: the cost of current dredging operations at seaports average about $200 million per year, and numerous proposals have been made to deepen ports that, if implemented, would greatly increase this cost. At four major coal ports alone—Hampton Roads, Baltimore, Mobile, and New Orleans/Baton Rouge—the capital costs of deepening channels for large ships is estimated to be $1.5 billion in 1980 dollars. Annual operation and maintenance (O&M) costs for these four ports currently range from $4 million for Baltimore to $19.5 million for New Orleans. Projected additional annual O&M costs resulting from the proposed channel-deepening projects range from *$800,000* for Baltimore to $75 million for New Orleans.

Funds for dredging have not been appropriated by Congress for any of the major coal-port dredging projects. Authorization of channel deepening has been approved for Baltimore. In addition, Corps studies have been completed and approved for the Hampton Roads harbors of Norfolk and Newport News. Studies of the

1980 U.S. Coal Export Trade



SOURCE Off Ice of Technology Assessment.

Mobile harbor have been completed by the Mobile district and are under review by the Corps. A draft report has been prepared for New Orleans that has yet to be reviewed. The Corps of Engineers has estimated that, if new, expedited procedures are adopted, all of these projects could be completed by the mid to late-1980's (see appendix A).

Major new dredging projects presently take an average of over two decades to progress through the various stages from project proposal to completion. This lengthy time period has tended to discourage the promotion of bulk trades such as coal which are switching to large, deep-draft ships. A variety of legislative proposals have been made to expedite dredging projects at U.S. coal ports. Because of budget limitations and a long-standing need to select among a multitude of proposals, it may well be necessary to establish priorities among ports for Federal funding. Although addressed by several congressional bills, there is currently *no* mechanism in place for establishing priorities for harbor dredging on a national level.

OTA analysis suggests there is general agreement among the private and public sector that some changes in current practices are needed. The notion of sharing Federal dredging costs in some form of user fees for those who directly benefit is gaining acceptance partly because of concerns that principal beneficiaries do not pay their share of the cost. Selecting certain ports for dredging first may be the only way to initiate some dredging for any ports. Lastly, streamlining the process, so long as environmental safeguards are maintained, may be necessary to assure timely attention to developing the U.S. coal export trade.

Due to the limited scope of this study, this technical memorandum has not addressed certain other issues relating to the dredging question:

- Opponents of dredging argue that the environmental costs of dredging could be substantial, while proponents of dredging contend that environmental damage will be minimal, given proper safeguards. No analysis was done during this study on this issue.
- Benefit-to-cost ratios ascertained in studies by the Corps of Engineers for major coal ports have ranged from 2:1 to 9:1. If these ratios are correct, the cost of dredging would be small compared to savings resulting from dredging. The savings that are considered are for reduced transportation costs for all deep-draft ships (of which coal colliers are only one group) that would use the port after it is dredged. However, past Corps' analyses have been criticized by some as biased in favor of water development projects. This study has not attempted to investigate the Corps' process *or* studies of specific ports.

ALTERNATIVE TECHNOLOGIES–THE OUTLOOK

The need for new technologies to handle coal for export will depend, in the long run, on the volume of exports and the efficiency of existing systems. Industrial developers may be forced to introduce new systems if expansion of existing facilities and transportation networks are unable to cope with the demand. There are a number of options including coal slurry pipelines, midstream transfer of barges or ships, barge-carrying ships, pneumatic pipelines, and shallow-draft, wide-beam ships.

During the preparation of this technical memorandum, OTA identified the most important of these alternative technologies, but has not analyzed or compared them. It is possible that one or more new approaches to transporting coal overseas could offer economic benefits that might outweigh those of more conventional systems now in use. However, economic comparisons have not been made and it is premature to judge their relative worth.

The Federal Government is not in a good position, compared with the private sector, to either evaluate or promote new technologies, Those that have been proposed are in the private sector and information about them is only partially available to the public. The coal transport business includes an enormous variety of private and public organizations that are not always motivated by the same concerns.

Some brief comments about future possibilities for coal transport may be useful. E.g., if new mines are opened in the Western United States strictly for export, some may find it efficient to create a complete mine-to-ship system dedicated to this purpose. Or, if large volume, long-term export contracts are negotiated for Eastern U.S. mines, it may make sense for others to build offshore, deep-water, coal-loading terminals. The Federal role in such cases might be to encourage development when the timing appears appropriate, but not necessarily to become directly involved.

While most of the research to develop alternative systems is being conducted by the private sector, certain Federal actions could help or hinder a decision to proceed to actual development. E.g., some have stated that if harbors are not dredged, it could force the development of alternative systems for offshore loading.

Alternative technologies will probably be approached with caution by established industries because they are perceived as long-term options. Many of the technologies still have to be developed. Moreover, foreign buyers, terminal operators, and shippers will have to agree when—and how—they should be adopted.

Chapter 2

Discussion of Issues

Chapter 2

Discussion of Issues

ISSUE 1: U.S. COAL EXPORT POTENTIAL

A series of comprehensive studies of the world coal situation have predicted massive increases in coal trade over the next two decades and a large U.S. share of that future market.[1] It is likely that goals of doubling or tripling coal usage for energy production in Europe and Japan will be achieved by the year 2000 because those countries have aggressive policies to reduce their dependence on OPEC oil.

Since most of the coal to satisfy the new demand in Europe and Japan will be imported, total world trade in steam coal could expand by 5 to 10 times and reach about 500 million tonnes per year (mmt/yr) in 2000. (World trade in metallurgical coal of 175 mmt/yr is expected to remain constant.)

The U.S. share of this new steam coal trade will depend on how well this country prepares for the export market in comparison with other major suppliers. This preparation includes providing ample and efficient facilities to handle the transportation and assuring foreign buyers of both U.S. competitive prices and a secure supply. The United States must maintain reliability of supply and price that compares favorably with Poland, South Africa, Australia, and maybe other supplier countries as well.

Under the previous administration, the Interagency Coal Export (ICE) Task Force prepared an analysis of future U.S. coal export potential drawing on previous studies such as the World Coal Study and International Energy Agency studies and using some newly available data on growing coal demand worldwide. A draft report was issued January 20, 1981. It predicted U.S. steam coal exports to grow to 200 mmt/yr by 2000. That figure did not include metallurgical coal and was based on assumptions of demand only in Europe and the Far East. It assumed U.S. prices would be only slightly higher than other suppliers and that foreign buyers would view the United States as a reliable source of Supply. [2]

Adding a level of 55 mmt/yr of metallurgical coal to the ICE projections would bring total U.S. exports to 255 mmt/yr by 2000. The projection appears achievable given aggressive efforts to promote these exports by both the Government and private industry and if developments in other countries do not drastically alter present trends.

Federal actions in dredging coal port harbors could have a substantial impact on U.S. price competitiveness. Federal actions in foreign trade policy development could have a sizable impact on foreign buyer's views of the relative security of U.S. coal supply in the future. Private industry in the United States appears to be making substantial investments to improve the coal export system, which should help to provide reliable supplies at competitive prices. [3]

Whether the goals of U.S. exporters will be achieved depends on a host of interrelated decisions by utilities, transporters, producers, and governments, but there are clear incentives to move toward U.S. coal usage by other countries and recent trends are supporting that movement.

International Trends and Actions

In the early effort to bring greater focus to the coal trade issue, the International Energy Agency (IEA) reviewed the prospects for steam coal to *2000* and published a report in 1978 examining this topic.[4] While some of the quantitative estimates are conservative in light of the more recent large increases in prices of alternative fossil fuels, the conclusions of the report advocate a massive substitution of coal for oil by both industrial societies and developing countries.

IEA also concluded that the creation of an immensely expanded world trade in coal is in part dependent on the adoption and execution of co-

ordinated Government policies to facilitate coal development and usage. Goals to increase coal use among the industrialized countries are stated in the studies referenced above and in the Tokyo economic summit communique of June 1979 and the Venice economic summit communique of June 1980.[5]

At the conclusion of the seven-nation economic summit meeting in Tokyo on June 29, 1979, the heads of state of Canada, the Federal Republic of Germany, France, Italy, Japan, the United Kingdom, and the United States focused on the issue of coal and agreed to increase as far as possible coal use, production, and trade, without damage to the environment,

In an effort to build on and strengthen the Tokyo **coal** pledge as well as to take a long-term view of coal production, utilization, and trade, the heads of state of the seven summit countries in their June 1980 Venice summit communique[6] indicated agreement on several points.

- They intend to double coal production and use by *2990..*
- They will encourage long-term commitments by coal producers and consumers.
- It will be necessary to improve infrastructure in both exporting and importing countries, as far as is economically justified, to ensure the required supply and use of coal.
- They will consider promptly the recommendations of the report of the IEA Coal Industry Advisory Board.
- They will do everything within their power to ensure that increased use of fossil-fuels, especially coal, does not damage the environment.

The IEA Governing Board in July 1979 approved the formation of the Coal Industry Advisory Board. It **was** created as a means to assist the industrialized countries in identifying and removing barriers to increased coal production, use, and trade, A report by that board submitted to IEA in December 1980 recommended specific government and industry actions to meet the goals of doubling coal use by 1990 and tripling it by 2000.[7]

World Coal Study

In June 1980, an analysis of the world's energy and coal prospects to 2000 was prepared by the Massachusetts Institute of Technology's World Coal Study,[8] an international project involving 80 people from 16 major coal-producing and consuming countries. Among the conclusions of the World Coal Study are:

- Coal is capable of supplying a high proportion of future energy needs. It now supplies more than 25 percent of the world's energy. Economically recoverable reserves are very large—many times those of oil and gas—and capable of meeting increasing demands well into the future.
- Coal will have to supply between one-half and two-thirds of the additional energy needed by the world during the next 20 years, even under the moderate energy growth assumptions of the study. To achieve this goal, world coal production will have to increase 2½ to 3 times.
- Many individual decisions must be made along the chain from coal producer to consumer to ensure that the required amounts are available when needed. Delays at any point affect the entire chain. This emphasizes the need for prompt and related actions by consumers, producers, governments, and other public authorities.

The ICE Task Force

Formed in the spring of 1980, the ICE Task Force considered the evidence of world coal supply and demand projections from previous studies and prepared some independent analyses. The ICE report, completed January 20, 1981, concludes that the United States will export 200 million tonnes of steam coal by 2000 or 40 percent of the total world trade in steam coal.[9]

The major uncertainties in this projection relate to comparative actions on price and reliability of supply among the present four major coal exporting countries: the United States, Poland, Australia, and South Africa.

The ICE Task Force concluded that the United States could obtain a stable share of the market as long as U.S. prices do not exceed a range of approximately 10 percent above other countries' delivered prices. If U.S. prices exceed this range, purchases would drop correspondingly. OTA believes that this conclusion is reasonable but it is difficult to tell how tradeoffs between price and other motivations will be calculated. The Task Force also stated that "if U.S. coal were generally priced at *$6* to $8/tonne above others' prices, the result would be to reduce the U.S. share of the European market from 30 to 25 percent. "

Despite the conditions that tend to keep U.S. prices relatively higher, the Task Force contended that the United States will "generally be able to maintain reasonable delivered prices for its coal. "

A component of U.S. attractiveness, as analyzed by ICE, is the expected high demand in consumer countries. "Demand for steam coal in the next 5 to 10 years is expected to exceed the production from non-United States sources, " it said, citing problems in building up nuclear power, coal's main competitor, as an alternative to oil.

Very few doubt that there will be a strong future coal demand. However, there are those who believe that the United States may not develop the required capabilities, policies, and price competitiveness to capture such a large share of the steam coal market as projected by ICE. Among the skeptics are some of the foreign buyers of U.S. coal.

Foreign Trade Factors

European and Japanese buyers of coal have been urging attention to the long-range capabilities of the United States to export coal. Some are skeptical that the Federal Government will take expeditious action or that the myriad of local and private interests can agree on a unified approach that some major expansions would require.

Since security of supply and price of U.S. coal in the future are interrelated factors affecting growth in U.S. exports, careful planning of all aspects of foreign coal trade appear to be essential to meet export goals. Private and Government decisions will be clearer if they are closely coordinated and based on information about Government and private actions together.

Harbor dredging, new terminal development, long-term contractual arrangements, total transportation network planning, and total public and private costs are all related. It appears that effective U.S. policy to encourage the coal export potential will require careful analysis and cooperation on many levels of government and industry.

Besides the four principal export nations, exporters such as Canada could also grow substantially in the future. Other countries that may become exporters in the future include Colombia, Indonesia, Mozambique, the People's Republic of China, and the Soviet Union. "

The U.S. share of the world market is dependent on interrelated considerations, such as the extent and rate of steam coal demand—how steam coal fits into the overall picture of the consuming country's energy supply, both in terms of aggregate energy demand, and in terms which energy resources are to be utilized to meet demand; the motivations and buying strategies of consumers; pricing and other policies of coal exporters competing with the United States; and actions taken by U.S. firms and the Federal Government affecting the attractiveness of the United States as an exporter.

Competitive Factors

U.S. attractiveness is in part affected by difficulties or potential difficulties competitors may experience:

- South Africa may be boycotted by several nations because of its racial policies. In addition, some foreign buyers are concerned that South Africa may experience future political instability.
- Australia had major strikes in 1980, which may recur in the future.
- Poland is severely curtailing exports of coal, and is not meeting previous commit-

ments. Coal reserves are not as abundant or as easily exploited as in other countries, and exports to other Soviet bloc countries, as well as domestic needs, may conflict with exports to Western Europe.

Aside from the United States and the other three major exporters, other coal-producing countries do not currently have sufficient mine capacity and infrastructure to export large quantities, New developments of mines and transport systems could change this outlook in the next decade.

The price of U.S. coal is now higher than that of its competitors, due in part to factors that cannot or are unlikely to be changed, such as higher labor costs and longer distances from mines to ports. Certain resulting price differentials, to the disfavor of the United States, are likely to continue even with actions such as harbor dredging to improve the U.S. competitive position. Thus, if buyers emphasize price, the U.S. share would tend to be residual–sold only if lower cost competitors were unable to offer sufficient quantities to meet demand.

On the other hand, the United States has potential advantages over one or more competitors in many other criteria. To the extent that buyers seek such goals as diversity and reliability of supply, and perceive that the United States provides these qualities, U.S. price disadvantages become less important. The more steam coal demand rises and the more impediments to sales experienced by U.S. competitors, the more U.S. exports should rise. The more efforts are made by both the Federal Government and U.S. industry to assure foreign buyers of meeting future commitments, the more U.S. exports should rise.

ISSUE 11: FEDERAL POLICY

Four departments—State, Commerce, Energy, and Defense's Corps of Engineers—each have specific responsibilities in coal exports, but their present activities are limited and not closely coordinated. The previous administration's efforts at coordination took the form of an interagency task force charged with preparing a report. It is not yet clear what form of Federal policy on coal exports will be adopted within the present administration. However, there are some indications that private industry is expected to take the necessary actions with very little Government involvement.

The previous administration's ICE Task Force report contains some Federal policy recommendations. It may be useful to consider them, among other ideas, in the formulation of future policy. During the coming months some level of Federal activities could, in cooperation with private initiatives, help achieve national goals for exporting coal.

While it is difficult to quantify benefits from Federal actions on foreign trade policy it is clear that much of the impression that foreign buyers have of the United States as a reliable coal trading partner comes from the real and perceived actions of the Federal Government.

This OTA analysis suggests that among the most important coal export initiatives by the Federal Government are decisions on harbor dredging proposals and on international trade policies. The dredging issue is discussed in issue III. Foreign trade policy development is discussed below.

Benefits of Coal Exports

In addition to the obvious benefits to industry, jobs, and the economy, the promotion of U.S. coal exports is viewed as providing some significant overall benefits to the Nation. During this study, OTA has not been able to quantify these benefits but only to identify some that appear important.

An often discussed national benefit is the improved balance of trade that coal exports bring. During 1980, the total value of U.S. coal exports was about $4.5 billion. This compares to a total balance-of-trade deficit for the same year of $24 billion. Therefore, one might expect future

growth in coal exports to significantly affect future balance of trade.

Another important national benefit is that of improving energy security for U.S. allies. To the extent that U.S. coal can provide them with a significant portion of their future energy needs, Western European countries will be less dependent on OPEC oil or even the proposed gas pipeline from the Soviet Union.

Finally, it has been noted by those in the port and shipping industry, that the viability of U.S. ports is vital to an overall healthy economy. Coal is an important foreign trade commodity, but only one of hundreds handled through major seaports. Coal represents about 10 percent of foreign import and export tonnage at present, although in some ports such as Hampton Roads, it is one of the major products handled. Given plausible growth rates, coal exports could account for a much larger fraction of exports over the next two decades.

Concerns of Foreign Buyers

In the development of U.S. foreign trade policies, it is important to understand some of the concerns of foreign buyers that could be addressed by those policies.

One major concern is that of U.S. labor disputes. In the past, the U.S. coal industry has experienced periodic strikes severely curtailing output. The last such strike lasted 110 days in *1977-78*. The United Mine Workers voted to strike against the Appalachian coaI industry in March 1981, and coal colliers began leaving the lines at Baltimore and Hampton Roads. Labor disputes affecting railroads and ports are also possible.

Another concern is the possibility that future domestic and political problems would be used as a reason to curtail or disrupt exports. Some foreign buyers would like to see a more clearly stated commitment to maintain export levels as part of U.S. coal export policy.

Past statements have included assurances that the Federal Government will not interfere with coal exports except in the case of national emergencies. However, Public Law 96-387, passed last year, gave concern to some foreign buyers that coal exports may suffer because of domestic problems, [13]

This law provides that, until June 30, 1987, domestic ships for which coal is readily available for loading may move ahead of other ships waiting to receive export coal. This puts domestic coal use into direct competition with export trade for available U.S. port and terminal facilities .14

The practical effort of this law has so far been slight. Available information indicates that no foreign ship has thus far been delayed in taking on coal at any U.S. port because of a demand by a domestic vessel. However, this law is of great symbolic importance, and is indicative of potential future problems in U.S. export reliability under conditions where domestic demand for coal may be sharply increased, such as an embargo of oil, or future changes in domestic policy on fuel use. Moreover, shifts in New England to coal, as planned, could lead to increased coastal shipping, preempting loading facilities.

In addition to security of supply, foreign buyers are also concerned about future U.S. prices. Some foreign countries such as the Netherlands, France, and Japan have very modern, deep-draft harbors in which they can unload the largest, and most economical, coal ships. They are concerned principally that the United States will not take firm action to develop harbors capable of handling large ships and, therefore, U.S. prices will always be much higher than those of other suppliers. Another factor affecting price of U.S. coal is high U.S. railroad freight rates and the lack of alternative systems to move coal from the mines to many of the major coal terminals. [15]

Views of Exporters and Administrators

U.S. exporters have many of the same concerns as foreign buyers. Private industry appears to be resolving some issues such as expanding dockside facilities and negotiating long-term contracts. However, foreign policy pronouncements and high-level Federal attention to supporting coal export trade is viewed as important to reaching the future potential.

The ICE Task Force report contained several specific suggestions for improving Federal policy in coal exports and these have some support from private and public groups who were involved with the Task Force efforts. [lb]

One suggestion is to designate a single point of contact for coal trade. Presumably one lead Federal agency could administer a special office. Many foreign governments as well as private companies are involved in coal trade negotiations. U.S. agencies such as the departments of State, Commerce, and Energy each have small activities in either promoting trade or facilitating international contacts—e.g., the Department of Commerce has trade attaches in U.S. Embassies abroad. The Department of Energy maintains contact with international organizations such as IEA. The nature of these agency functions at present seems to preclude either close cooperation or high-level policy attention.

A possible private-sector activity suggested by the ICE Task Force is to develop a U.S. Coal Export Trade Association. A number of coal producers (particularly with Western U.S. coal reserves) and coal transportation organizations have recommended the establishment of an International Coal Trade Organization or Association to act as a forum for the interests of the U.S. coal export industry. Similar organizations exist to represent the international coal interests of Australia and South Africa. In addition, there are government coal trade organizations in Poland and the Soviet Union.

The members of the existing U.S. Coal Exporters Association are coal brokers or are actively involved in coal export transactions. The recommended new organization would include a larger group of those potentially involved in coal exports and the associated infrastructure. Other suggestions included in the ICE Task Force report include:

- encourage foreign investment in U.S. mines and facilities;
- expand marketing aid programs;
- initiate bilateral conferences with major coal trade partners;
- establish an office to monitor U.S. coal export development (i.e., continue the Task Force work); and
- establish an international coal trade delegation.

Each of these suggestions and others will need careful scrutiny if they are considered for adoption. However, a well-coordinated and focused Federal role in coal export policy could be important to meeting coal export goals.

The principal categories of Federal Government actions that could increase the ability of U.S. firms to export coal and help alleviate some of the more obvious foreign concerns are:

- political pronouncements creating a climate conducive to foreign coal use, U.S. coal production, and U.S. exports;
- actions to increase U.S. physical capacity to export coal; and
- marketing activities to increase the actual sale of coal.

Within each sphere is a range of possible actions, which can be listed by degree of Federal involvement. Certain political pronouncements can be among the most productive Federal actions. The administration and Congress could reaffirm the U.S. commitment to increase domestic coal production, improve necessary infrastructure, and increase exports. The United States could also encourage other nations to increase coal use. This can be done both in domestic and international forums. International forums include economic summit conferences. Statements of Federal Government support for increasing coal exports will be important if a major U.S. share of this trade is to be attained.

ISSUE III: DREDGING

Increasingly, oceanborne trade in bulk commodities such as coal is being conducted via deep-draft vessels, which over many trade routes offer substantial savings to shippers and their customers. Many parties believe that if the United States is to remain competitive in the

world coal market, it is essential that at least some U.S. harbors serving coal export facilities be deepened in order to accommodate deep-draft bulk carriers. A major avenue by which the Federal Government may assist coal exports is the dredging of access channels for ports with existing or projected coal export facilities. Two areas of debate that have surfaced in relation to the Federal role in dredging are:

1. *Sharing of costs between Federal and non-Federal parties.* Proposed channel improvements at four major coal ports alone would cost about $1.5 billion, Federal budget constraints and changing perceptions concerning the desirable scope of Federal responsibilities have been reflected in suggestions to shift part of the cost burden of dredging away from the Federal Government, the party currently accepting financial responsibility for channel-deepening projects. The Reagan administration and some members of Congress have proposed changes in current practices towards recovery of an increased proportion of Federal costs through user fees imposed on perceived beneficiaries of dredging. However, there is debate over who the principal beneficiaries are, and the effect of user charges on U.S. exports. Also, specific user-fee mechanisms remain to be worked out.

2. *Expediting dredging.* Dredging projects presently take decades to progress through the various stages from project proposal to completion. This system is seen by many authorities as seriously impeding the growth of U.S. bulk-cargo capabilities. Proposals have been made to streamline the process by which dredging projects are approved and funded. Also, there is currently no national mechanism in place for establishing priorities among various proposed dredging projects. It may be necessary to create such a mechanism in order for decisions on individual projects to be made expeditiously.

Cost Sharing

Introduction

Since 1824, the Corps of Engineers has had Federal responsibility for improvement and maintenance dredging of channels of the Nation's ports and inland waterways. For all U.S. inland waterway and seaport projects, the Corps spent more than $1 billion on dredging during 3 years from 1978 through 1980 (see app. A). About two-thirds of this amount was spent for maintenance dredging. '7

Proposals have been made for new dredging at many ports, partially or primarily justified by coal export considerations. According to the ICE Task Force, 34 ports have been identified as having a potential for serving increased steam coal exports. Nine of these are already engaged in coal export. 1[8] At four existing coal ports alone—Hampton Roads, Baltimore, Mobile, and New Orleans/Baton Rouge—the capital cost of proposed channel improvements would total almost $1.5 billion in 1980 dollars. Annual operation and maintenance costs for existing channels at these four ports range from $4 million for Baltimore to $19.5 million for New Orleans. The channel improvements proposed would create additional operation and maintenance costs, ranging from *$800,000* for Baltimore to *$75 million* for New Orleans. "

In company with many other Federal programs, the current extent of Federal involvement in dredging is the subject of increasing debate. With administration budget cutbacks, the question of how to divide the limited funds to be allocated among dredging projects has gained importance. Sharing of costs is one way of dealing with these new constraints. Full Government responsibility for dredging is considered by some to be an unnecessary subsidy to private industry and other non-Federal interests.

Cost-Sharing Mechanisms.

Although private-sector responsibility for dredging is a policy alternative, debates over

the Federal role in dredging have generally envisioned retention of overall Federal responsibility, while shifting varying proportions of dredging costs to non-Federal parties. Cost sharing can be geared towards recovery of all costs, or of some percentage of the expenses of Federal dredging operations. Mechanisms can be tailored to specific harbors, or generalized to all harbors. Two basic varieties of cost-sharing mechanisms exist: user charges and direct contributions.

User charges.—User-related fees are assessed by port authorities on vessels for such things as pilotage, dockage, wharfage, lading, and stevedoring. Historically, user charges have received more attention as an option for recovering inland waterway expenditures than for maritime- related expenditures such as port dredging. Cost-sharing mechanisms suggested for inland waterways include user charges, some of which are potentially relevant to seaports. Some sources have looked specifically at user fees in connection with deep-draft dredging.[20] Examples of fees include:

- *License fees* imposed on operators of vessels. Fees can be uniform, or can vary according to draft, weight, capacity, or other physical dimension of a vessel.
- *Taxes.* Taxes could be levied on *cargos,* based on such criteria as commodity, weight, or value. *Fuel taxes* have been proposed by several sources to help pay for inland waterway construction and maintenance projects. Under the Inland Waterways Revenue Act of 1978, a fuel tax will be levied starting at 4 cents/gal in 1981 and progressively rising to 10 cents/gal in 1986. The Reagan administration has proposed that this tax be increased to cover a greater proportion of inland waterway costs. However, the utility of a fuel tax to cover seaport dredging costs is doubtful. The Congressional Budget Office judged that such taxes could easily be avoided by those engaged in international shipping .21
- *Harbor and channel use* fees. A fee could be levied each time a ship uses a dredged channel. This could be at a flat rate for all ships or a graduated rate based on draft. Alternatively, the fee could be based on deadweight tonnage (roughly the weight of cargo) or on net registered tonnage (roughly the volume available for cargo). Harbor and channel use fees based on net registered tonnage are used by many foreign ports and for determining canal tolls.

Direct contributions. —Direct contributions could be assessed on non-Federal sources such as States or port authorities to help finance port developments. Potential sources also include foreign companies and countries, who are among the chief potential beneficiaries of dredging projects .22 The methods by which targeted parties could raise funds to share costs vary—e.g., States and port authorities could float bonds.

Combinations.—Combinations of cost-sharing mechanisms are possible. Several proposals have suggested that agencies responsible for ports, such as port authorities, reimburse the Federal Government for channel deepening, collecting necessary funds by adding on de facto user charges to those they already assess, such as dockage, or by charging a separate harbor use tax to deep-draft vessels taking advantage of added depths.[23] State or local responsibility has been opposed by most States and port authorities, who have argued that the Federal Government has jurisdiction over navigable waterways and has sole authority to collect user fees.[24] One possible alternative to local collection of fees would be direct collection by the Federal Government —e.g., employing the U.S. Customs Service or Coast Guard.

Observations. Problems in estimating user charge fees and the effect of such fees on U.S. exports will be addressed at the end of this section. Though a detailed description or comparison of cost-sharing mechanisms is beyond the scope of this memorandum, a few observations may be made.

User charges appear to be the cost-sharing mode with the most precedent and support. Out of the welter of potential beneficiaries of dredging for coal exports, many believe that shipping companies and their customers should be the

parties who bear some portion of dredging costs in company with the Federal Government .25

If this argument is accepted, the main question is what sort of user charges should be employed. The U.S. Customs Service collects a small tonnage tax on international shipping which totaled $14 million in 1980.[2]6 There could be advantages to broadening this tax to recover dredging expenses, as the administrative machinery for collection is already in place. In addition, because it is imposed on a systemwide basis for all international vessels using U.S. ports, dredging costs would be spread widely, and therefore would be less burdensome on individual ships. However, an important drawback of such a tax is that precisely because it is spread so widely, beneficiaries would not pay what many would consider an equitable share of costs, and nonbeneficiaries—in this case, shallow-draft ships—would end up helping to subsidize dredging projects. If a tonnage tax were imposed on a port-by-port rather than uniform basis, this inequity would be reduced .27

A potentially more equitable alternative is a harbor- and channel-use fee based on ship draft, with a sliding scale in which the deepest draft ships pay the greatest charge. Relatively shallow-draft but large volume or value-cargo vessels, such as container ships, would be penalized under user charges based on tonnage, volume, or value, as would proposed new technology bulk carriers with large volumes but shallow-drafts. A user charge based on ship draft would link dredging project benefits and beneficiaries together in a more direct way. OTA contacts with interested groups indicate that this option has attracted relatively greater support than other forms of cost sharing. However, no study or legislative proposal appears to have considered this option in detail.

Cost-Sharing Proposals

The Reagan administration has proposed that user fees be applied to a variety of Government services, including certain Coast Guard activities, and aspects of the aviation system .2* Although not specifying a collection mechanism, deep-draft dredging has recently been included in administration user-fee proposals. Beginning in 1983, user charges "will recover, through proprietary receipts, the [full] cost of dredging and maintaining deep-water channels leading to our seaports, except for that portion allocated to Government [e.g., Navy use]. Together [with inland waterway user charges], these proposals will increase revenues by $2.1 billion over the 1983 to 1986 period, offsetting costs otherwise borne by the general taxpayer. "29

Legislation has been submitted to implement the administration proposals, which would have "appropriate non-Federal public bodies" become responsible for reimbursing the Federal Government for certain dredging expenditures, and which would give such bodies the authority to collect user fees .30

Current congressional bills that would make non-Federal parties partners in deep-draft dredging cost sharing include S. 576 (Moynihan, Randolph) and S. 621 (Domenici, Moynihan).[3]' This approach was also present in the water policy initiatives proposed by the Carter administration in 1978.[32] These proposals do not specify how such parties would raise funds.

Despite this interest in cost sharing, there have been few in-depth studies of mechanisms that apply specifically to seaports. The Corps of Engineers is looking at the issue of cost sharing, but no formal study is being made. The Department of Transportation is preparing a study on waterway user taxes and charges for navigation projects including deep-draft channels and coastal ports, as mandated by the Inland Waterways Revenue Act of 1978. This study should be completed by October of this year.

Arguments For and Against Cost Sharing

In addition to reducing Federal expenditures, proponents advance two major types of justifications for cost sharing: efficiency and equity. 33

Efficiency .—Critics of the present system argue that when taxpayers pay the bulk of the cost of a project, inefficiencies result: interested parties are likely to promote projects that may not be cost effective.

This problem, it is contended, occurs despite the nominal role of the Army Corps of Engi-

neers in conducting benefit-cost analysis of projects. Critics of the Corps argue that Corps district offices tend to become the allies of local interests in promoting projects. In addition, it is argued, benefit-cost analysis is an inexact discipline, heavily dependent on value judgments of what constitute the benefits and costs to be included in the analysis, and subject to manipulation.

Cost sharing establishes a crude but potentially effective market-like mechanism to encourage closer scrutiny of projects. As noted by one environmentalist, "The willingness of beneficiaries to cover costs is perhaps the best test of the economic merits of a water project. "[34]

These arguments have been countered in several ways. Opponents of cost sharing as a means to increase efficiency argue that deep-draft improvements are economically justified, as proved not only by favorable Corps of Engineers benefit-cost analyses (the objectivity and rigor of which are defended), but also by the financial commitments made by private industry, port authorities, and governmental units to improvements at ports targeted for dredging. Without hard financial judgments about the likelihood of increased business brought about by the combination of dredging and shoreside port improvements, it is argued, these improvements would not be made.

It is also argued that if dredging projects were prevented because of refusal by targeted parties to share costs, national benefits (described below) could be lost, resulting in greater net inefficiencies than are present in the current arrangement of Federal financial responsibility .35

Equity .—Perhaps more important than efficiency arguments are arguments related to the equity of cost sharing. Advocates of cost sharing contend that it is inequitable for the Federal Government to bear the entire responsibility for deep-draft dredging operations.

Though definitions of equity vary greatly, one principle is commonly held: to the extent easible, beneficiaries of actions should bear the costs generated by those actions. Cost-sharing proponents contend that although some benefits accrue on a national scale, the primary beneficiaries of dredging projects are specific private or geographic entities, rather than the Nation as a whole. Federal dredging is thus viewed as a subsidy to these entities, and cost sharing is viewed as a means to increase equity.

User charges are levied on other transportation-related items, such as highway use (e.g., through gasoline taxes) and airports (e.g., through aviation fuel taxes and ticket surcharges). All transportation sectors can claim similar national benefits; it is seen as unfair that dredging be completely a Federal responsibility.

Opponents of cost sharing also argue their positions on a basis of equity. Arguments have usually focused on perceived inequities of requiring port operators to contribute to dredging costs. 36

Contributions by non-Federal parties. Cost sharing, it is argued, should be viewed in the context of ports and harbors as a whole, rather than in regard to dredging alone. If ports rather than dredging are taken as the unit of analysis, non-Federal contributions become substantial and constitute adequate sharing of costs.

There have been billions of dollars in private-sector investment for port facilities and other infrastructure necessary to export coal and other commodities —e. g., most coal-loading dock facilities are owned by railroads or other private companies, Private firms have indicated willingness to spend additional hundreds of millions of dollars to increase U.S. coal export capacity at ports. Investment by port authorities in port facilities is similarly large, almost equalling the Federal investment in navigation works.

Local governments are required to undertake what are called conditions of local cooperation in partnership with the Corps of Engineers to facilitate dredging operations. These often entail such things as "procurement of property or property rights, relocation of pipelines and aerial cables, deepening of terminal areas, bridge improvements or modifications, third party liability, business and residential relocations, and the provision of spoil disposal and containment facilities."[37] If further cost sharing is required, it

is argued, the Federal Government should in turn share the revenues gained from such sources as import duties and tonnage taxes, with port authorities, States, and/or other involved parties.

Analysis of these arguments depends on judgment of whether or not dredging should be viewed as a separate item, or in the context of port development as a whole. Some of the arguments against cost sharing become moot if port authorities are given the power to charge user fees by legislation, and such legislation is found to be constitutional in the event of court challenge. Arguments are also inapplicable to direct Federal collection of fees.

The national interest in deep-draft dredging. Opponents of cost sharing argue that seaports and actions that enhance their capacity, such as dredging, should be viewed in terms of national rather than local interests. Some of the benefits of dredging do not accrue to specific parties, but to broad regions of the country, to the United States as a whole, and even on an international scale, to U.S. allies and foreign policy interests. Federal responsibility is thus seen as appropriate.

As stated by a spokesman for the American Association of Port Authorities (AAPA), "Seaports are unique among water resource projects. Seaports are essentially transportation facilities. They are an integral part of a vast global ocean transportation structure that fosters the exchange of peoples, cultures, ideas, technologies and goods. Seaports are also a part of United States maritime and trade policy, and in time of national emergency, the nation's defense logistical system ."[38]

Benefits of seaports are widely distributed:

- More than a million jobs are created, and billions of dollars worth of trade is conducted every year, with billions contributed to Federal, State, and local taxes.
- Ports serve large interstate regions. Inland States have a direct stake in the ability of ports to move their products overseas, and to take in needed raw materials and finished goods.
- The United States is the world's largest importer and exporter, and it depends on international waterborne trade to reduce its balance-of-payments deficit.
- Trade in specific commodities can be tied to foreign policy actions, e.g., as demonstrated in both the sale and embargo of grain to the Soviet Union.

Federal investment in ports is considered by the industry as cost effective. They argue that ports contribute billions of dollars annually to customs revenues which are taken in by the Federal Government .39

It is also argued that dredging is a necessary part of port capability. If U.S. ports lag in modernization and expansion, the alternative, as stated by AAPA, is "to fall behind the world in ocean transportation technology and become a nation of obsolete ports able only to serve obsolete ships, with the price of resultant inefficiency ultimately passed on to the U.S. consumer. "4°

The benefits of dredging for coal export purposes can be national in scope, e.g.:

- Increases in coal exports will improve the U.S balance of trade with other countries. Last year, saIes of U.S. coal of all types totaled approximately $4.5 billion. Exports have the potential to grow to levels significantly above this by the end of the century. (Dredging, would help the movement of other commodities using deep-draft vessels, such as grain, oil, and ores).
- U.S. coal exports provide an alternative for U.S. allies to dependence upon OPEC or the Soviet bloc for energy resources.

It is argued that the national and international aspects of these benefits make Federal responsibility equitable.

As with arguments based on efficiency grounds, some of the equity arguments are not directly relevant to a situation in which user fees are assessed on shippers. A more specific counter argument to the ones expressed immediately above would be that seaports are not intrinsically different from other transportation-

related facilities in terms of the extent to which they serve both local and national interests. If cost sharing is appropriate for airports, highways, and inland waterways, there is no apriori reason that it should not be applied to seaports as well .42

Impediments to national interests entailed by cost sharing. Opponents of cost sharing argue that cost sharing will injure national interests either by preventing dredging projects from going forward, and/or by discouraging foreign shippers from calling at dredged ports.

It is argued that State and local governments or authorities, especially in poorer States, will be unable to pay even a low percentage of costs, let alone be responsible for full-cost reimbursement. Many port authorities are municipal or county agencies, special districts, or private concerns without powers to tax, and with no way to pass along assessments or costs .43 States feel that they would need a Federal mandate to charge user fees. If States could not charge such fees they may forego dredging projects. One potential problem would arise if a State in which a project was located were to have sole cost-sharing responsibility, despite the likelihood that other States would also benefit from the project .44

A second argument is that even if States could pass user charges on, the effect could be to discourage deep-draft vessels from calling at dredged ports. To the extent such charges add on to the costs of doing business, it is argued, the United States would suffer in competition with other suppliers of coal, such as Australia and South Africa, which already sell at lower prices than the United States.

Perhaps more pressing questions are raised by the second argument, as user charges are a more likely mode of cost sharing than direct contributions by States or other non-Federal units. Unfortunately, information is insufficient to make conclusions as to the potential effects of cost sharing on U.S. exports.

By enabling deeper draft vessel trade, dredging could result in savings from $3 to $6/tonne of coal on voyages from U.S. east coast ports to Western Europe.45 presumably, so long as user charges were beneath savings, foreign buyers would not be discouraged from purchasing U.S. coal solely on this basis. However, while it appears plausible that the user charges envisioned in some scenarios would not impose a sufficiently great burden to discourage foreign coal buyers, no detailed analysis is available.

A major problem in determining the effect of user charges is the difficulty in arriving at valid estimates of user charge amounts. Estimates depend on assumptions about a great number of variables: the type of user charge decided on (e.g., tonnage tax or **ship** draft), the costs which the charge is supposed to defray (e.g., new construction, operation and maintenance, or both, for projects at all ports or port-specific), the size of the population paying charges (e. g., the number of ship calls or amount of tonnage), the number of years to payback, and rate of interest.

Few analyses have been published containing estimates of possible user charges. Those estimates that have appeared vary from below that *$0.20* to $1.70/tonne of cargo. The disincentives these charges would pose is dependent on such factors as the perceived equity of charges, their effect on delivered U.S. coal prices vis-a-vis those of competitors, and motivations behind foreign purchases of U.S. coal (e. g., the extent to which price considerations outweigh benefits of diversification and reliability of supply potentially offered by the United States). Another possible comparison is between economic gains to shippers resulting from dredging v. amount of user fees imposed.

The type of user charge decided on is an important variable in calculating fees. E.g., if it is based on total tonnage carried by international shipping into and out of U.S. ports, the amount of charge added would probably be minimal. As calculated by the Congressional Budget Office (CBO), the **corps of** Engineers and the Coast Guard spend about *$560* million per year improving and maintaining ports and channels to accommodate oceangoing vessels and Great Lakes shipping. According to CBO, "If the Federal Government recovered all deep-draft expenditures from international shipping alone, shipping costs would increase by *30* cents/

tonne, or less than 0.2 percent. Such a level seems unlikely to harm the general economy or divert significant traffic to other ports or transportation modes."[47] A 30-cents tonne charge would be only 5 percent of a *$6* tonne savings from dredging.

However, it is hard to tell how applicable a **30 cents/tonne** figure would be for coal export dredging projects. CBO calculations were based on tonnage figures encompassing all imports and exports from all seaports and Great Lakes ports, and include domestic traffic as well .47 The number of users and the amount of tonnage across which charges would be spread is thus much larger in the CBO assessment than would be the case for user fees based on shipping at coal export ports alone.

Two other ways of considering the disincentives a user charge would pose are to compare user charges with other expenses shippers pay, and with the total value of cargo. One source estimated a charge of *$20,000* per use of a dredged harbor by a 125,000-tonne vessel .48 This fee is less than the daily expense of operating a ship of this size, and is about the same as daily demurrage fees charged to vessels that must wait to load or unload.

In comparison with the total value of a cargo of coal, **$20,000** is quite small. In 1980, the average cost of all coal at the port before shipping was $50/tonne.[49] For a 125,0()()-deadweight tonne (dwt) fully loaded vessel, the cargo would thus on average be worth $6.25 million; $20,000 in user fees would represent **0.32** percent of value of the cargo.

Higher fees would change the above comparisons. Depending on the assumptions made, fees could be many times the figures mentioned immediately above. One source mentioned a possible charge of $1.70/tonne on export trade at four major coal ports. '" For a 125,000 dwt fully loaded vessel, this would result in a charge of $212,500, or 3.4 percent of cargo value. Another possible disincentive of a user charge applied to exports alone is that it may be seen as inequitable by foreign buyers.

Lastly, foreign motivations are important. As discussed earlier, the United States is not competing entirely on the basis of price with foreign competitors. To the extent that buyers choose U.S. coal for reasons of national security (e.g., diversity of supply, perceived *reliability* of U.S. source), user charges at moderate levels should not discourage purchases.

Problems in Implementing Cost Sharing

Much work remains to be done in conceptualizing the specific mechanisms by which user charges may be calculated and collected. No cost-sharing scheme will be able to avoid perceived inequities—e.g., if user charges are tailored to specific projects at specific ports, those ports that require more expensive projects to achieve comparable harbor depths would have to impose greater fees, potentially driving shippers to use other ports. On the other hand, systemwide charges could subsidize expensive and potentially inefficient projects. Another problem is establishing equitable fees for all ports, some of which may have been dredged before the fees were implemented.

Expediting Dredging

A major concern of both foreign and domestic parties seeking increased U.S. coal exports is the length of time currently required to deepen harbors. From the time of issuance of a congressional resolution directing the Corps of Engineers to conduct a study to the time the Corps' report clears the necessary levels of administrative review has averaged 9 to 10 years. Awaiting congressional authorization and funding has averaged another 6 to 7 years. The execution of a project, including advanced planning, design, and construction has averaged an additional 8 years .51

According to a different source, on average, it takes more than 20 years, from the initiation of planning up to the beginning of construction, to proceed through the various stages required in the Corps' process, with construction taking up to an additional 10 years.[sz] Another source gave an average of over 24 years from authorization of a study to completion of construction .53

Some of the reasons for this time lag involve the procedures required for Corps' projects. Once a congressional committee authorizes a project study, the proposal must wend its way through multiple stages of review before work actually begins.[54] (See app. A for a description of the 19 major steps in the Corps process, the status of each major port-dredging project under study, and the internal Corps' proposals for expediting the work under their control.)

Funds for dredging have not been appropriated by Congress for any of the major coal port dredging projects. Authorization of channel deepening has been approved for Baltimore. Completion of the Corps' studies has, in addition to the one for Baltimore, been completed and approved by the Corps for the Hampton Roads harbors of Norfolk and Newport News. Studies of Mobile harbor have been completed by the Mobile district and are under review by the Corps. A draft report has been prepared for New Orleans which has yet to undergo review.

Several proposals that would expedite aspects of Corps' procedures, or related actions by other parties have been made. Their rationale is that if the benefits of coal exports are to materialize, quick action on dredging is essential. With present depths, the United States will not be able to export as much coal as it could otherwise, and indeed may lose some market share if deepened facilities are not available in the near future.

Measures to accelerate project implementation at the major coal harbors will require wide departure from normal authorization and funding procedures for planning and construction. Several categories of action were listed by an ICE subgroup paper:[55]

- Expedite the review of harbor improvement reports by all Federal and State agencies by directing concurrent reviews and urging the various reviewing agencies (both Federal and State) to use less than statutory time allowance where possible.
- Authorize funds and initiate project advance engineering and design studies before congressional authorization of construction. Because much of the delay in implementing projects is associated with waiting for funds after the project is authorized, this would cut 3 to 4 years from the normal planning cycle.
- Phase construction to accelerate specific channel segment improvement and incremental deepening to achieve maximum benefits from the use of larger ships.

Another category of action is to establish priorities among dredging projects, concentrating at least initial resources on one or more selected sites.

Proposals from several sources are summarized below:

- In October 1980, President Carter announced support of legislation that would provide blanket congressional authorization for those harbor improvement projects approved in the administrative review process, thereby allowing the projects to qualify for appropriation of funds and the immediate commencement of projects for which funds were otherwise available. '[b]
- In September *1980,* the Corps of Engineers released a proposal for the purpose of speeding up the review process needed to obtain Federal permits:

  "Responding to a Presidential request in August 1980, the Secretary of the Army, acting through the Corps of Engineers and in consultation with the ICE Task Force, implemented steps to shave several months from the "preauthorization" review process, and for approved projects, to compress the advanced engineering and construction activities so as to accelerate the benefits of dredging by making a deepened outbound channel operational at the earliest possible time.[57]
- At least one congressional bill would set a time limit on the process of studying the feasibility of harbor projects, reducing the study period to 2 years from the current average of 9 to 10 years to 2 years .58

Another approach is to establish an explicit procedure to decide priorities among alternative navigation improvement projects, rather than simply establishing through case-by-case legislation which improvements are to be funded.

One congressional proposal would establish an interagency task force to act as a planning and coordinating body for proposed coal port projects, reviewing Corps feasibility studies, developing long-range harbor development plans, and advising the President on which projects are in the highest national interest. 59

A number of bills have had the following features:[bo]

- Bills provide for "fast-track" procedures for specific navigation improvement projects at specifically named ports, although projects at other ports may also be able to qualify for the expedited handling procedures proposed.
- Eligibility for expedited handling is based on congressional judgment that the navigation improvements involved are economically justified, feasible from an engineering standpoint, and essential to the interests of the United States and its allies.
- The Corps is to submit to Congress a final environmental impact statement (EIS) demonstrating compliance with the National Environmental Policy Act of 1969, the Clean Water Act, and other environmental statutes. Unless Congress disapproves of such an EIS by concurrent resolution within *60* days of receipt, the project may go forward without any further actions under the environmental statutes mentioned above. A lack of disapproval constitutes a finding and determination by Congress that the requirements of such statutes have been satisfied in connection with the project concerned.
- A congressional finding as defined above, and actions to carry out projects themselves, shall not be subject to judicial review unless claims are brought against them within 60 days of the finding or action concerned. Claims are to be given expedited hearing by the court in which they are filed.
- EISs are to be prepared by the Corps on an expedited basis.

ICE supported legislation with provisions for congressional review of EISs, "with the provision that through congressional hearings or otherwise, a fair opportunity be provided for the presentation of objections to any such project on environmental grounds because of particular concerns over dredge disposal."[61]

Some environmentalists have raised objections to the expediting procedures proposed above. There is fear that compression of environmental review and curtailment of legal appeals will mean inadequate scrutiny of projects, possibly leading to unwarranted and environmentally damaging activities. By giving Congress a limited amount of time to act in reviewing EISs, and by requiring a high threshold of action in order to reject an EIS, such proposals, it is feared, would lead to a situation in which Congress will be unable to review EISs in-depth and unlikely to act to reject them. The limitations upon legal challenges are similarly seen as threatening. 62

Footnotes

I Some of the major comprehensive studies are:

a) *Interim Report of the* ***Interagency Coal Export Task Force,*** **Jan. 20, 1981, with 14** volumes of working documents.

b) "Coal: **Bridge to the Future, " by Carol Wilson, Massachusetts Institute of Technology, 1980 (sponsored by** DOE), ***World Coal Study.***

c) Steam Coal: Prospects to 2000, International Energy Agency (Paris, Organization **for Economic Cooperation and** Development, **1978).**

d) ***Report of the IEA Coal Industry Advisory Board,*** IEA (Paris, OECD, December 1980).

e) ***A Forecast for U.S. Coal*** **in** *the* ***1980's,*** **National** Coal Association, **January 1981,**

f) ***Outlook for The Lon,g-Term Coal Supply and Demand Trend in the Community,*** **Commission of the European Communities, Brussels, March 1980.**

[a]**Interim** ***Report of the ICE*** *Task Force.*

[3]***See*** ch. 3 for a compilation of coal port developments now underway.

[4]***Steam Coal: Prospects to*** 2000.

'Interagency Coal Export Task Force International Cooperation–Subgroup Report, January 1981.

[b]Ibid.

'Report of the IEA Coal industry Advisory Board.

[8]***World Coal Study.***

'Interim Report of the ICE Task Force.

[10]Interviews with representatives of the Commission of the European Communities and other buyers of U.S. coal.

[11]Ibid.

[12]*Interim Report of the ICE Task Force.*

[13]Ibid,

[14]U.S. Congress, Senate, *An Act to Amend the Merchant Marine Act* of 1936, Public Law 96-387, 96th Cong., 2d sess., 1980, S. 1442.

[15]Interviews with some representatives of buyers of U.S. coal.

[16]Interim *Report* of *the ICE Task Force.*

"Status and *Trends of U.S. Port Developments and Coal Exports,* Simat, Helliesen & Eichner, Inc., Mar. 3, 1980 (OTA contractor paper), pp. 96-97 (hereinafter called *SH&E).*

[18]*Report* of the Interagency Coal Export Task Force, DOE/FE-0012, January 1981, p. 5-45 (hereinafter called *ICE Report).*

19U.S. Army Corps of Engineers, DAEN-CWP-P, Oct. 2, 1980.

[20]Inland waterway user charge mechanisms are listed in Waterway *User Charges,* American Enterprise Institute, Sept. 30, 1977, p. 21-30. David L. Anderson, Robert W. Schuessler, Peter A. Cardellichio, *Deep-Draft Navigation User Charges: Recovery Options and Impacts,* U.S. Department of Transportation, Transportation Systems Center, August 1977, has the most comprehensive discussion of deep-draft oriented user fees.

21 Reducing the Federal *Budget: Strategies and Examples, Fiscal Years 1982-1986,* Congressional Budget Office, February 1981, pp. 96-97.

[22]Precedents for foreign cost sharing include improvements to a port in British Columbia partially underwritten by the Japanese. There is a similar offer relating to the port of Astoria, Oreg.

[23]SH&E, op. cit., p. 93.

"E.g., statement by representative of the American Association of Port Authorities, *Hearing Record,* Subcommittee on Water Resources of the Committee on Public Works and Transportation, House of Representatives, March and April 1979, pp. 1210-6 generally.

[25]Panel discussion, Mar. 5, 1981 at OTA.

[26]CB0, op. cit., p. 96.

[27]See discussion in Anderson, et. al., ch. 3.

[28]The rationale for user fees was stated in equity terms: "Most Government programs are designed to benefit the Nation as a whole, or provide special assistance to needy or vulnerable groups. Some activities, however, provide direct economic benefits to a specific and known group of individuals or enterprises. While it is often necessary or desirable for these activities to be conducted by the Federal Government, it is clearly inequitable for the general taxpayer to bear the burden of services that provide special benefits for specific users. The budget reform plan provides for shifting the cost of some such activities to those who directly benefit. " *America's New Beginning: A Program for Economic Recovery,* Office of Management and Budget, February 1981, p. 19.

[29]Fiscal year 1982 *Budget Revisions,* Office of Management and Budget, March 1981, p. 103, so.

[30]Introduced as S. 809 by Sen. Stafford, Mar. 26, 1981.

[31]The applicable part of S. 576 reads:

Projects may proceed under two methods of financing, depending on the desirability of the project from the national perspective. For the best projects, the first method of financing provides for the initial payment of all construction cost by the Federal Government and the repayment of 23 percent of such costs within 20 years of the completion of the project. The rate of interest on repayment will be set by the Secretary of the Treasury. For projects financed in this way, the Federal Government will assume the full cost of operation and maintenance for the first 3 years after the completion of the project. In each year thereafter, the Federal share of such costs will be reduced by 5 percent until the Federal share represents 50 percent of annual operation and maintenance costs.

For the projects of lower national priority, the Federal share of the construction cost will be set as a proportion commensurate with the proportion of the most cost-effective dredging depth in the depth preferred by the non-Federal interests. The non-Federal interests shall repay the Federal Government for the portion of Federal construction costs greater than 50 percent. Under this method of financing the Federal share of the operation and maintenance costs will be the same percentage as the Federal share of construction costs for the first 5 years following construction. Thereafter, the Federal share will be reduced by 5 percent each year until the Federal share represents 25 percent of operation and maintenance costs." Congressional Record, Feb. 26, 1981.

S. 621 would establish "a system of grants to the States for their use in priority projects to be built by Federal agencies, using Federal designs, with 75 percent Federal money, 25 percent non-Federal." At the same time there would be a special national category of interstate projects numbering 10 at any one time that would continue to be built at Federal cost. *Congressional Record,* Mar. 5, 1981.

[32]To Summarize the relevant aspects of the Carter proposals (introduced with some modifications as S. 1599 in July 1979 by Senator Gravel), a State in which a new water resource project was to be constructed would assume a share of costs over and above previously existing cost-sharing arrangements. For projects having "vendible outputs''—where revenue is received from users of such projects—the State share was to be 10 percent. For projects with nonvendible outputs, the share would be 5 percent. State contributions would be paid concurrently and proportionately with the Federal contracted obligation for program construction, with a cap of one-fourth of 1 percent of the State's general revenues for each project. Navigation projects, including dredging, were originally classed as having vendible outputs, but were later reclassified as nonvendible. The manner in which States would collect funds towards their contributions, e.g., from other States which would benefit from a project, was left unspecified. For already approved projects, the cost-sharing requirement would not apply, However, such projects would be expedited if the States concerned were to voluntarily enter into a cost- sharing agreement over and above previously existing ones.

[33]These categories are suggested by American Enterprise Institute, op. cit., p. 13-20. The Carter administration argued a third reason for cost sharing: involvement. "States seldom participate in project funding, and thus do not have a major role in determining project priorities" (Hearing Record, op. cit., 1187). Cost sharing would give

States "a greater stake in the outcome of water project authorization and budgeting decisions" (p. 5). However, States and State organizations which submitted comments on the Carter initiatives almost unanimously rejected this position, arguing that the Carter initiatives were not desired by States, and did not translate into meaningful decisionmaking power.

"Statement, Brent Blackwelder, Environmental Policy Center, ***Hearing Record,*** p. ***276.***

[35]Supra note 24.

[36]These arguments have been drawn primarily from discussions of the Carter water initiatives.

[37]***Hearing Record,*** p. ***1212.***

"Ibid., p. **1210. See also, e.g.,** ***Journal of Commerce,*** Oct. **17, 1980, article, "Cost Sharing: A Port Dilemma. "**

[39]The Federal Government collects more than $5 billion annually in customs revenues from seaports. Ibid.

[40]***Hearing Record,*** p. **1214**

"Senator Johnston, in introducing a bill in the 96th Congress which would have expedited dredging at several harbors for coal export purposes, gave another national security rationale for increasing coal exports: "Mr. President, it is important for everyone to realize that the burning of coal anywhere in the world, insofar as it displaces oil, is just as good for the local energy crisis, as the burning of that coal in this country because, to the extent that a ton of coal is burned in Amsterdam it displaces a number of barrels of oil used there, and frees up oil for use in this and other countries around the world. " ***Congressional Record,*** Dec. 5, 1980.

It may be noted that if present trends continue, benefits will not include greater opportunities for U.S. shipping, as deep-draft colliers are almost entirely foreign flag.

[42]Another set of arguments may be directed at the national benefits of dredging for coal exports.

- The necessity of dredging to realize the benefits of coal exports is not given. As analyzed elsewhere in this report, several considerations may reduce the relative importance of dredging.
  - —current bottlenecks at coal export facilities are less the result of shallow-harbor bottoms than problems in shoreside handling, e.g., caused by slowdowns due to frozen coal, inefficiencies in handling metallurgical coal.
  - —different technologies than those used at present could reduce dredging requirements (e. g., coal slurry loading, shallow-draft ships with increased capacity).
- The U.S. coal export market may not be large enough to justify dredging at every port which seeks it.
- Dredging entails environmental costs, the extent of which depend on such things as the presence of toxic chemicals in dredged material, type and density of marine and freshwater life in the areas in which dredging and spoil disposal take place, and the method of disposal used. To some parties, the costs involved in dredging projects at particular harbors would exceed the benefits gained.

"Hearing Record, pp. 1166, 1217.

'"Ibid. p. 54-56.

"See, e.g., James A. Lisnyk, "The Ocean Shipping of Coal," presented at Coal and Ports Seminar, AAPA, New Orleans, Feb. 1981, p. 10.

Variables affecting savings include mode of propulsion, flag of vessel, and length of voyage. Deep-draft vessels would not result in savings in two cases, east coast port coal exports to Japan, and west coast export to Western Europe. The Panama Canal cannot accommodate vessels over approximately **70,000 dwt, and savings from** deep draft do not equal savings from using the Canal.

[46]BO, op. cit.

CBO estimates were extrapolated from table 1151, Sta***tistical Abstract of The United States,*** 100th ed., U.S. Department of Commerce, September 1979. Telephone conversation, CBO, Mar. 17, 1981.

[48]The charge, a flat fee assessed on all deep-draft ships using a hypothetical deepened channel, was calculated by dividing annual payments by a local agency to defray costs of a loan financing a project, by number of deep- draft vessel calls. SH&E, op. cit., p. 94.

*'Figure obtained by dividing total value of coal exports by total export tonnage (both metallurgical and steam coal).

[50]***Wall Street journal,*** Mar. 30, 1981.

[51]CE ***Report,*** p. 1-18.

[52]***Moving U.S. Coal to Export Markets,*** Army Corps of Engineers, Department of Commerce, Department of Energy, Department of Transportation. Draft dated June 10, **1980, p. 5-15.**

[53]**1nteragency Coal Export Task** Force ***Report on Ports and Ocean Transportation,*** draft dated Dec. 1, 1980, p. V-51.

[54]Ibid. note 2, 5-16-5-17.

[55]Interagency Coal Export Task Force Report on ports on ***Ocean Transportation, ibid,*** p. V-60.

"ICE Report, p. 1-19.

[57]Ibid. See Federal ***Register,*** part VI, Department of Defense, Corps of Engineers, Department of the Army, "Proposal to Amend Permit Regulations for Controlling Certain Activities in Waters of the United States, " Sept. 19, 1980, p. 62732.

[58]S. **576 (Moynihan, Randolph),** ***Congressional Record,*** Feb. 26, 1981.

[59]***1bid.***

[60]E.g. S. 3247 (Warner, et. al.), S. 68 (Randolph), S. 202 (Hollings), H.R. 55 (Boggs).

[61]CE Report, ***ibid.***

[62]Letter, Brent Blackwelder, Environmental Policy Center, to Senator Warner, Jan. 27, 1981.

Chapter 3

Port and Shipping Technologies for Exporting Coal



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Port and Shipping Technologies for Exporting Coal

BACKGROUND

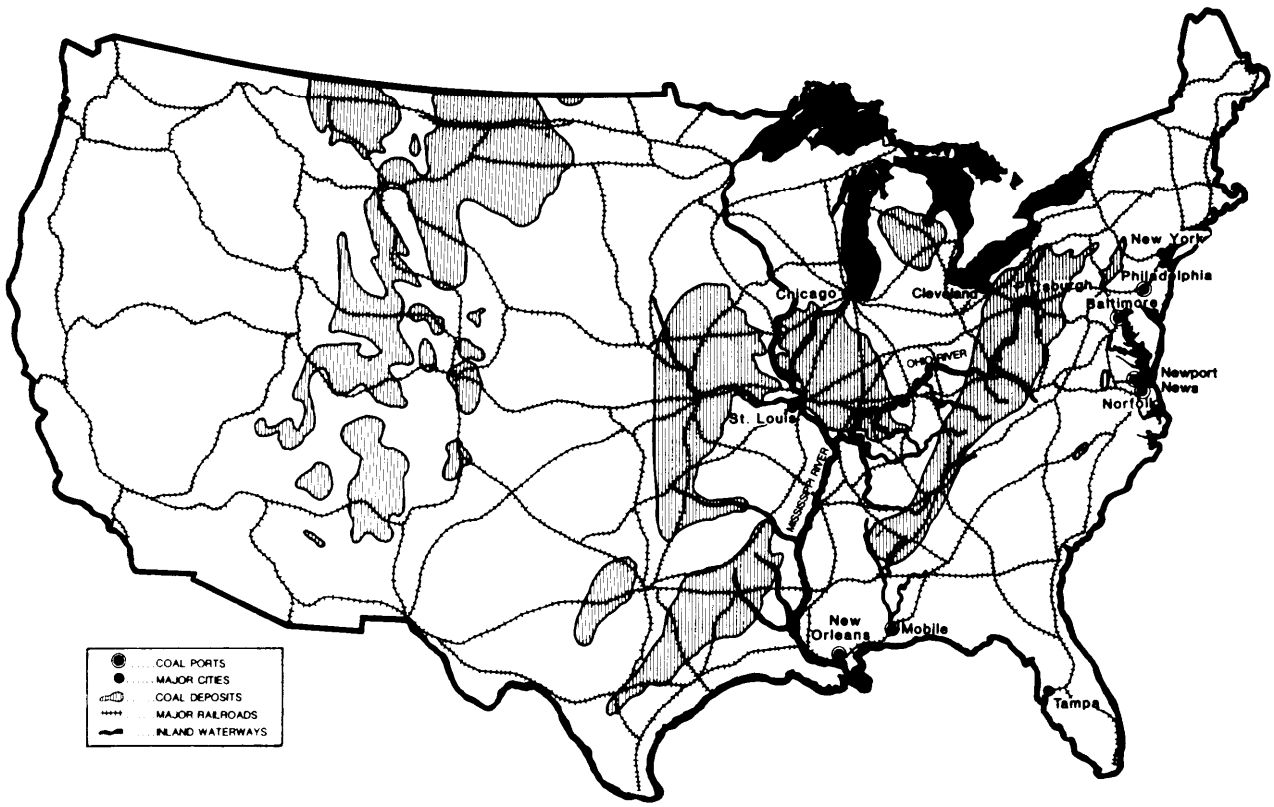
Most U.S. coal is exported through just a few large terminals at major east coast, gulf coast, and Great Lakes ports.

U.S. coal deposits are found in 31 of the 50 States (see fig. 2). Appalachian coal deposits are predominantly deep and have thin seams. Presently mined Western coal is extracted in strip and surface mines. The Powder River region in northwest Wyoming and southeast Montana contains about 40 percent of the U.S. surface coal reserves. Low-sulfur coal is found in the West and in central Appalachian mines. High-sulfur coal is predominantly located in the Midwest and in northern Appalachian mines. At present almost all export coal is high-Btu bituminous coal from Appalachian mines. Exports of Western coal to the Far East may become important in the future if Pacific Coast transportation and terminals are developed.

Brief History of U.S. Coal Exports

The history of U.S. coal exports begins in the late 1800's when small quantities were shipped

Figure 2.— Major U.S. Coal Deposits, Transportation Systems, and Coal Ports



SOURCE Dravo Corp

90-396 O - 82 - 6

to Canada and the east coast of South America. European demand for U.S. coal began by the turn of the century and increased steadily up to World War I. In 1917, approximately *24* million tonnes (mmt) were exported to foreign buyers. By 1920, 38 mmt left U.S. ports, with 22 mmt bound for non-Canadian points.

Exports dropped to a low of 9 mmt in 1932, and remained below the 20-mmt level through most of the 1940's. Immediately following World War II, the United States emerged as a major coal supplier with levels reaching 69 mmt in 1947—used primarily by European nations seeking to rebuild industrial activity. The level achieved in 1947 was not reached again until 1957 when total exports exceeded *76.4* mmt. Following that year, coal leaving U.S. ports was always less than the 1957 totals, until 1980, when almost 90 mmt were exported. (See table 2.)

Metallurgical grade coal dominated U.S. exports in the past. This coal is converted into coke in large heating ovens and eventually used for processing iron ore into steel.

All existing major east coast coal export terminals were developed by railroad companies. Their primary purpose is to handle metallurgical coal which requires complicated blending, and hence, massive rail-classification yard setups. Up to recently, steam coal was exported only through Great Lakes ports to Canada.

The Situation in Existing Coal Ports

The increasing foreign demand for U.S. steam coal has exerted a number of physical, operational, and administrative burdens on existing port-handling capacity.

The facilities designed for metallurgical coal, which requires extensive sorting and blending of coal types, are not as suitable for steam coal. The terminals at Baltimore and Hampton Roads have been operating at near 100-percent capacity, allowing no margin for errors or mechanical failure.

Historically, the ports of Hampton Roads, Baltimore, Philadelphia, Mobile, and New Orleans have handled almost all of U.S. coal exports desined for overseas markets. In addition, a number of ports on the Great Lakes have shipped sizable quantities of coal to Canada. Most notable are the facilities at Ashtabula, Conneaut, Sandusky, and Toledo, Ohio. During 1980, two major terminals in Hampton Roads handled 51.8 mmt of export coal, one major terminal in Baltimore handled 12.1 mmt, one in New Orleans 3.8 mmt, and one in Mobile *2.4* mmt. Excluding shipments to Canada, these four ports handled 98 percent of all export coal. (See table 3.) They each operated at full capacity and continued to search for various ways to

Table 2.—History of U.S. Coai Exports (thousands of short tons)

Year	Production	Exports	Export as a percent of product ion
1945	577,617	27,956	4.8
1946	533,922	41,197	7.7
1947	630,624	68,667	10.9
1948	599,518	45,930	7.7
1949	437,868	27,842	6.4
1950	516,311	25,468	4.9
1951	533,665	56,722	10.6
1952	466,841	47,643	10.2
1953	457,290	33,760	7.4
1954	391,706	31,041	7.9
1955	464,633	51,277	11.0
1956	500,874	68,553	13.7
1957	492,704	76,446	15.5
1958	410,446	50,293	12.3
1959	412,028	37,253	9.0
1960	415,512	36,541	8.8
1961	402,977	34,970	8.7
1962	422,149	38,413	9.1
19(13	458,928	47,078	10.3
1964	486,998	47,969	9.9
1965	512,088	50,181	9.8
1966	533,881	49,302	9.2
1967	552,626	49,528	9.0
1968	545,245	50,637	9.3
1969	560,505	56,234	10.0
1970	602,932	70,944	11.8
1971	552,192	56,633	10.3
1972	595,386	55,997	9.4
1973	591,738	52,870	8.9
1974	603,406	59,926	9.9
1975	648,438	65,669	10.1
1976	678,685	59,406	8.8
1977	691,344	53,687	7.8
1978	665,127	39,825	6.0
1979	776,299	64,783	8.3
1980	830,000	89,882	10.8

SOURCE: National Coal Association, *International Coa/: 1979* (Washington, D. C., 1980).

Table 3.—U.S. Exports of Bituminous Coal (thousands of short tons)

Seaport	1974	1975	1976	1977	1978	1979	1980
Hampton Roads. .	35,745	36,952	32,000	24,244	15,396	33,753	51,773
Baltimore	5,949	6,769	6,327	7,055	5,887	9,141	12,124
Philadelphia	1,431	802	447	187	90	55	1,522
New Orleans.	992	1,292	1,297	1,432	1,388	1,410	3,826
Mobile.	1,746	2,745	2,755	3,611	1,848	1,284	2,447
Great Lakes	14,063	17,108	16,580	17,158	15,214	19,140	18,189
Total	59,926	65,669	59,406	53,687	39,825	64,783	89,882

SOURCE U.S. Department of Commerce, as reported in National Coal Association, *International Coal: 1979.*

squeeze out more capacity. The massive 1980 demand for U.S. coal was caused by some unusual factors in other supplier countries—most notably the labor disputes in Poland, which took that country out of the present export business, and strikes in Australia, which disrupted their production.

Long lines of ships, some waiting for more than *2* months, are now outside of Baltimore and Hampton Roads harbors. These ships incur demurrage costs of $15,000 to $20,00()/day. This situation will probably not continue but major new terminal capacity—even on an emergency basis—is still many months away.

The five major U.S. (east and gulf) ports are each in the process of expanding existing terminals, and constructing new piers, open storage areas, and handling equipment. The proximity to the Appalachian mines, along with the existing rail and equipment infrastructure, has supported the investment at these terminals. The substantial activity at the Chesapeake Bay terminals will probably ensure that they retain an important future role in the coal export trade. Gulf coast exporting facilities will also be important in the coal export trade, particularly since both barge and rail networks can be used to deliver coal to the ports and can assure inland transport-price competition.

Recent private investments within the coal mining and coal transportation industries have followed from the surge in foreign buying demand. Substantial levels of investment are needed to construct coal-handling terminals, stacker/reclaimer systems, rail-yard trackage, and support equipment. Few private firms had sought to construct new export facilities during previous decades. Following World War II, demand for U.S. mined coal was fairly stable and the major railroad carriers had met the need for export capacities. Those railroads were the Chessie System (Baltimore and Ohio, Chesapeake and Ohio, and Western Maryland; now part of the CSX System following merger with Seaboard Coast Lines), Norfolk and Western (merger negotiations in final stages with Southern Railroad), and Conrail (formerly Pennsylvania Railroad and New York Central Railroad).

Proposals for New Coal Ports

Ports on the Great Lakes, Atlantic, gulf, and west coasts are in the process of planning new facilities. In general, proposals for facilities along the Atlantic and gulf coasts appear to be advancing more rapidly than those on the Great Lakes or west coast.

Three new terminals are planned for Baltimore, one of which is under construction, which should increase the export capacity by about *40* mmt. Two or three new terminals planned for the Hampton Roads area, one starting construction soon, would also add about 40-mmt capacity there. Mobile is now adding 5-mmt capacity to its terminal. Plans for Philadelphia and New Orleans will add to the above, thus providing strong evidence that the total capacity of these five traditional ports could double within the next 5 years. (See table 4.) Despite the limited shipping season and 27-ft maximum depth on the Great Lakes, proposals are receiving considerable attention and several projects are moving ahead, most notably Erie, Pa., Buffalo, N. Y., and Conneaut, Ohio, Indeed, a major Canadian steamship line will begin to export coal from U.S. ports on the Great Lakes in self-

Table 4.—Summary of Existing and Proposed Facilities at Five Major Coal-Handling Ports (short tons)

Port owner	Location	Current capacity estimates (millions of tons~	Proposed capacity expansion (millions of tons)a	Cost (millions of dollars)	Completion date
Hampton Roads					
Norfolk & Western Railroadb	**Norfolk: Pier 5**	**4.0**	1.0	—	—
	Norfolk: Pier 6	**29.0**	**7.3**	—	—
Chessie Railroadb (Chesapeake & Ohio)	**Newport News: Pier 14**	**16.5**	—	—	—
	Newport News: Pier 15	**5.3**	**5.0**	—	—
A. T. Massey Coal Co.	**Newport News: Pier 9 and adjacent areas**		**5.0**	$ 6 0	**1983**
Cox Enterprises	**Craney Island**		**20.0**	100	—
Baltimore					
Chessie Railroadb (Baltimore & Ohio)	**Curtis Bay**	**16.6**	**11.0**	20	**1981**
Chessie Railroadb (Western Maryland)	**Port Covington**	3.0	—	—	—
Consolidation Coal	**Canton**		15.0	**110**	**1984**
Soros Association	**Marley Neck**		15.0	**270**	**1985**
Phiiadelphia					
Conrailb	**Greenwich: Pier 124**	**2.5**	10.0	—	**1984**
Mobiie					
Alabama State Docksb Department	**McDuffie Island**	**5.5**	5.0	55	1986
New Orleans international Marineb Terminals	**Davant, LA**	7.0	3.0	—	—
Electro-Coal	**Burnside**	—	—	**200**	—

aTaken from U.S. Department of Energy, *Interim Report of the Interagency Coa/ Export Task Force* (January 1981, P. 1-13).
'Existing facility.

SOURCE: Office of Technology Assessment,

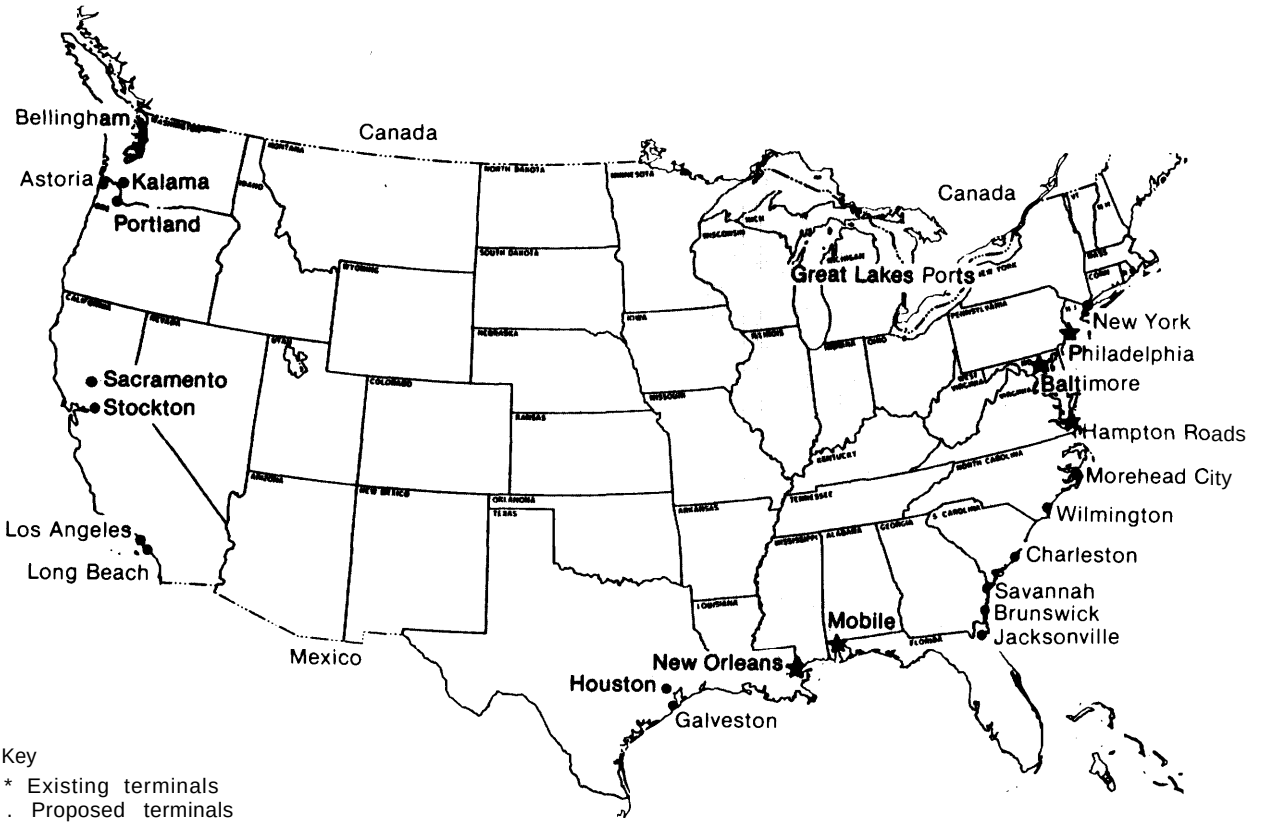
unloaders for transshipment at deeper draft ports on the St. Lawrence River. At Pacific Northwest and California ports, a series of proposals are also advancing rapidly. Figure 3 illustrates the location of various proposals for coal port development around the country.

Transportation Networks

The coal export industry has traditionally relied on rail-to-port or barge-to-port transportation. The existing networks of rail trackage and inland waterways have required regular upgrading and improvement, and several significant modifications have occurred or are in the process of being developed. Perhaps most notable in the rail industry are the spate of mergers which will allow for easy switching of coal flow from mine to export point. The mergers also have disadvantages because they may reduce price competition in this sector of coal transportation.

In addition to the existing networks, new technologies are evolving for moving coal for export. Coal slurry systems have received considerable attention and have demonstrated their feasibility on specific inland routes, although some problems remain in developing systems for overseas exports. Large steam-coal handling terminals, such as at McDuffie Island in Mobile, combine high-capacity handling and open storage for efficient coal export. Other new techniques are evolving for ship-to-ship transfer of coal. This would allow shallow-draft ships loading coal at Great Lakes ports to traverse the narrow locks of the Welland Canal, and St. Lawrence River, and then load onto large deep-draft vessels close to the mouth of the St. Lawrence Seaway.

Figure 3.—Existing and Proposed Coal Piers, Continental United States



SOURCE Office of Technology Assessment

INLAND NETWORKS AND SYSTEMS

The movement of coal over existing networks can be classified into long- and short-distance transport (gathering and distribution systems).[1] Long-distance transport primarily involves unit trains and barge.

Railroads to Ports

The primary form of coal movement in the United States is by rail, and more specifically, by unit trains. A unit train is a single-purpose dedicated train used for hauling a single commodity. It is composed of special-purpose cars which haul continuously between a mine and the consumer. The trains may move over *800*-miles/day instead of the 60-miles/day associated with general freight schedules. For the railroad companies, unit trains provide better equipment and plant utilization than do other rail modes.

In some instances, the cars employed in unit train service are owned or leased by either the shipper (coal mining company) or consignee (domestic utility company), although, railroad-owned equipment is used more often on a lease-out basis,

Historically, the unit train evolved in competitive response to the many coal slurry pipe-

[1]This categorical breakdown is discussed **in Bureau of Mines, Department of Interior,** ***Comparative*** **Coal** *Transportation Costs: An Economic* ***and Engineering Analysis of Truck, Belt, Rail, Barge, Coal Slurry, and Pneumatic Pipelines*** (prepared by Center **for Advanced Computation, University of Illinois at Urbana, Champaign,** 1977).

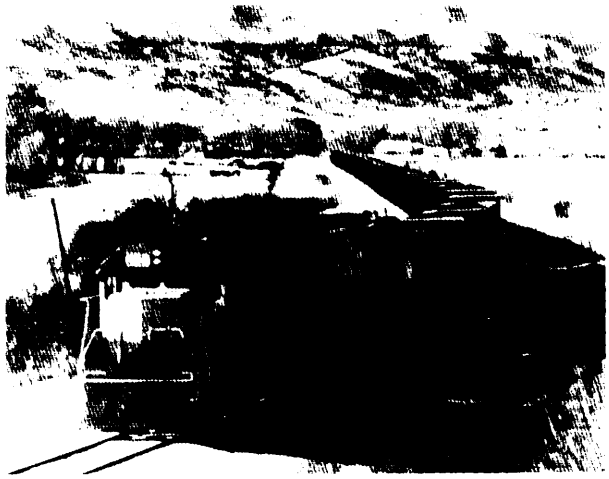


Photo credit: Ortner Freight Car Co.

Typical 100-car unit coal train

lines which were being proposed in the 1950's. The first operational slurry line connected a southern Ohio coal field with a major Cleveland, Ohio utility.[2] The railroads argued that unit trains were the only means available to compete effectively. The resulting reduced rates eliminated most slurry proposals. From the mid-1960's to the present, unit train use has been growing.

Given the forecast levels of future domestic and foreign coal demand, and the possible future shift from Appalachian mined coal to Rocky Mountain supplies, extensive railroad equipment expansion is anticipated. The emphasis will be on more powerful locomotives and larger hopper cars. However, increasing rail capacity involves a wide variety of problems. Railroad track beds must be upgraded to a level at which they can endure the anticipated heavier usage.

The adequacy of rolling stock and existing lines have a significant and directly measurable impact on unit train costing, system capacity, and hence, rates charged to foreign buyers. Inadequate equipment limits the number of trains available, leading to increased prices and limited throughput. Inadequate tracks and roadbeds reduce train speed and also contribute to escalated costs.

To remain competitive, the major coal-carrying railroads are upgrading their systems. One of the major constraints is the need for additional steel for trackage. While U.S. steel production capacity is more than adequate, shortages are known to occur. Some researchers have proposed that the U.S. Corps of Engineers could be a central organization for the rebuilding and extension of rail systems.[3] The Corps has already been involved in the relocation of rail lines in connection with dams and waterway projects.

The United States has 41 class 1 railroads.[4] Of these, 10 account for 88 percent of total coal traffic, and 4 are currently handling the predominant share of coal for export. The four are: CSX (Baltimore & Ohio for the Port of Baltimore and Chesapeake and Ohio for the Port of Hampton Roads), Conrail (Port of Philadelphia), and Norfolk & Western (Port of Hampton Roads) (see table 5).

The rail lines to be used to haul the projected increases in coal export traffic through 1990 are shown in figure 3.[5]

Barges to Ports

Commodity transportation by barge is possible on about 25,000 miles of navigable inland waterways in the contiguous 48 States. Even though the railroads have carried the major portion of the coal produced in this country, the inland waterways handled 14 percent of the total in *1975.*

The location of the major river systems make waterways an attractive means by which to move the projected volumes of coal from central Appalachia and the northern Great Plains to the gulf. Until the recent steam coal export boom, very little attention had been paid to shipping

[1] This line has since been closed. It and the Black Mesa line were the only two used to transfer coal in the United States.

[3] B. Hannor and R. Findley, "Railroading the Army Engineers: A Proposal for a National Transportation Engineering Agency," National *Resources Journal,* spring, 1977.

[4] A class 1 railroad is one with annual operating revenue of over $50 million in 1978.

[5] Taken from Corps of Engineers, *Moving U.S. Coal to Export Markets,* June 1980.

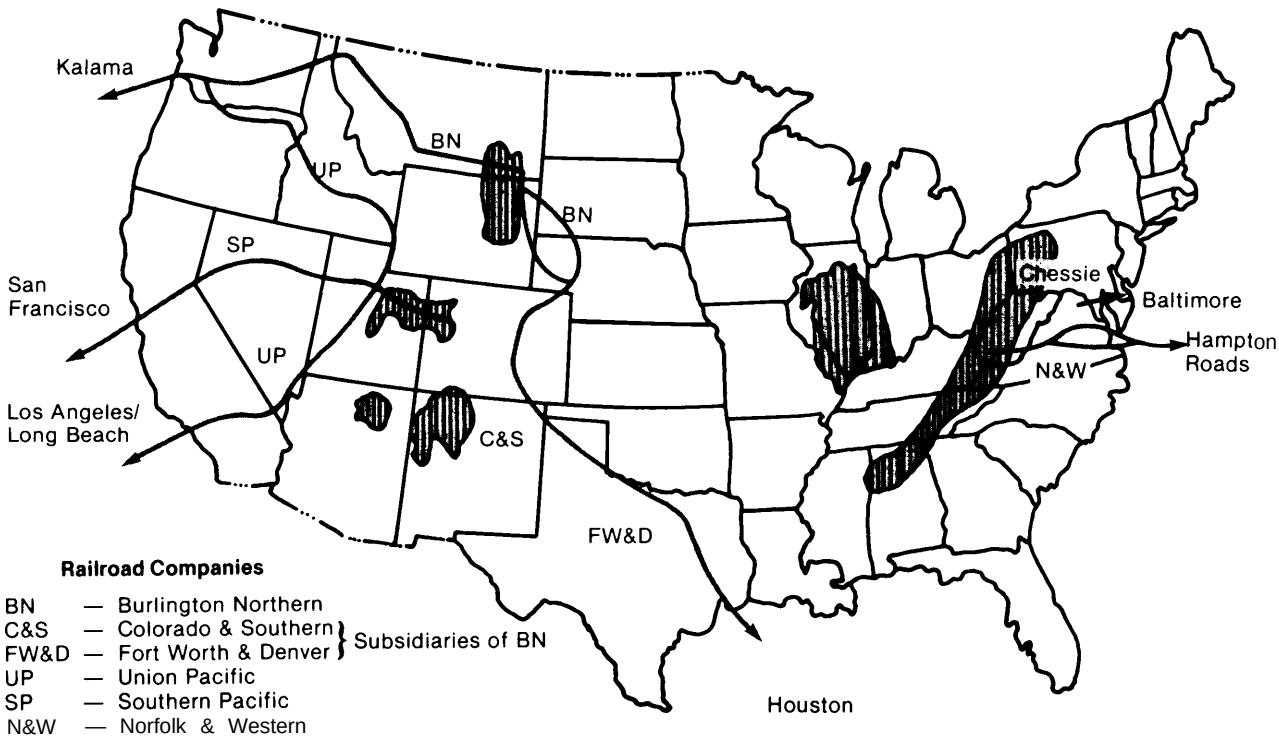
Table 5.—Rail-Carried Coal Tonnage for 1978 (short tons)

Railroad	Tonnagea (millions of tons)	Percent	Port used for export tonnage in 1980
Baltimore & Ohio[b] (CSX System)	21.5	5.8	Baltimore
Burlington Northern	63.0	17.0	—
Chesapeake & Ohio[b] (CSX System)	43.6	11.8	Hampton Roads
Conrail[b]	31.6	8.5	Philadelphia
Denver & Rio Grande Western	13.2	3.6	—
Illinois Central Gulf	15.0	4.0	—
Louisville & Nashville (CSX System)	53.7	14.5	—
Norfolk & Western[b]	47.3	12.8	Hampton Roads
Southern	28.3	7.6	—
Union Pacific	17.3	4.7	—
Others	36.3	9.8	—
Total	370.8	100.070	

[a]These tonnage figures are for all coal movements, of which exports constitute only a portion.
[b]Exlstlng major coal export railroad

SOURCE National Coal Association, Coal *Traffic Annual, 1979* edition (Washington, D.C. , 1980), p II-8.

Figure 4.— Principal U.S. Coal Basins and Rail Transportation Routes to the Export Market



SOURCE Interagency Coal Export Task Force

coal by river for export transshipment at gulf coast ports. The ports of Mobile and New Orleans have a number of terminal facilities to accommodate future export levels, and several additional projects are either in the design or development stage.

The inland waterway systems in mid-America are improved by *265* locks, channel alinements, bank stabilizations, modifications, and cutoffs. They are maintained by the Corps of Engineers by periodic dredging, cleaning, and snagging of the channels. The Corps operates most of the

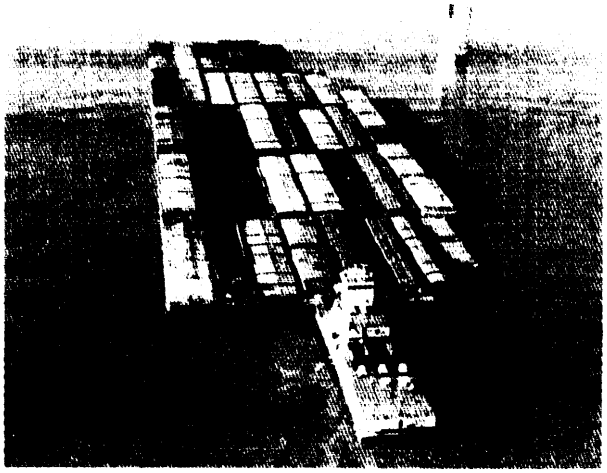


Photo Credit: Dravo Corp.

Typical unit tow operating on the Lower Mississippi River, showing in excess of 30 barges being moved by a single towboat

locks and maintains most of the improved waterways and harbors.

Several constraints hinder the movement of coal for export through the mid-America inland waterway system. The current drought plaguing many portions of the United States has reduced the navigable channel areas dramatically. The low-water levels along the inland river systems are a source of major concern and have led to safety and navigation difficulties, and reduced traffic flows.

A second constraint is the passage of coal-barge tows through locks particularly above St. Louis, Mo. Frequently, more than one tow will arrive at a lock at the same time. The result is congestion and waiting lines of up to several hours or even days to pass through locks. Scheduling of traffic to stagger arrivals could reduce some delays and the resulting costs of waiting.

MAJOR COAL PORTS AND TERMINALS

Historically, the Port of Hampton Roads has handled approximately 75 percent of U.S. overseas coal exports. The Port of Baltimore has been secondmost in the 20-percent range, and the ports of Mobile, New Orleans, and Philadelphia have followed. Each of these facilities will be discussed in turn, with emphasis in the discussion given to new proposals for development.

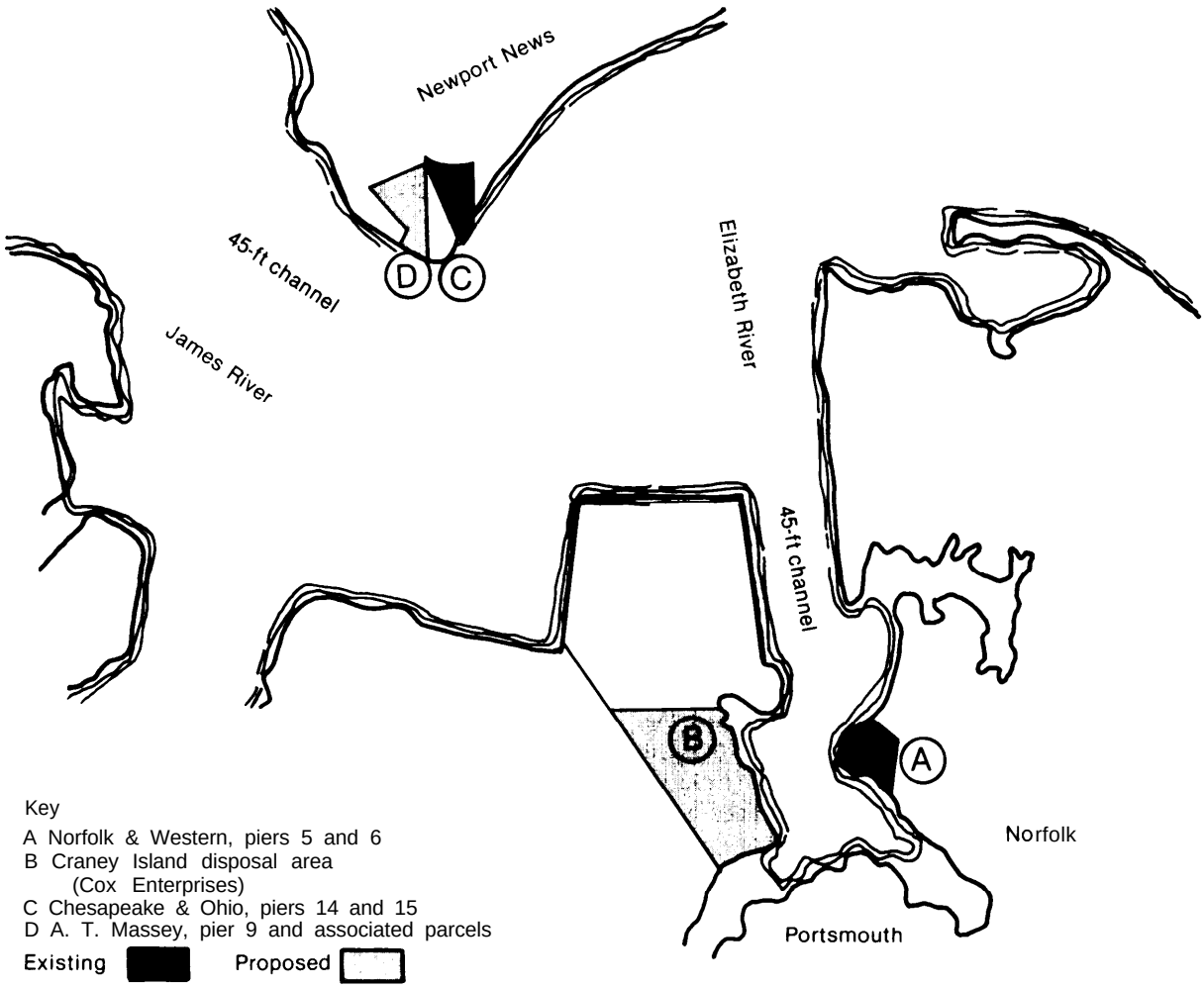
Several major firm proposals have been made for upgrading existing terminals, constructing terminals at ports currently exporting coal, and for developing entirely new projects at ports which have not historically handled coal. Whether schemes for dramatic expansion or the provision of entirely new facilities elsewhere, such as those proposed for the New York/New Jersey area, will be adopted is more questionable. But short leadtimes are required for some midstream transfer operations on the Great Lakes and the Mississippi River Delta at New Orleans, which are now being pursued.

Port of Hampton Roads

In 1979 the Port of Hampton Roads exported *33.8* mmt of coal and during 1980, this total increased to 51.8 mmt. According to the Virginia Ports Authority (VPA), the Port of Hampton Roads will export 75 mmt/yr by 1985—more than the entire United States for 1979. Besides the easy waterway access for vessels to reach Hampton Roads, the major factor leading to the predominance of Hampton Roads as a coal export site is its proximity to Appalachian coalfields.

The Port of Hampton Roads is currently serviced by two major coal-loading terminals, each owned by railroad companies (figure 5). The Norfolk & Western (N&W) Railroad own and operate piers 5 and 6 at Lambert Point on the Norfolk side of the Hampton Roads area. Pier *6* is the larger of the two facilities and acts as the terminus of coal originating from more than 200 producers on the N&W rail system. Channel

Figure 5.— Existing and Proposed Coal Piers, Port of Hampton Roads



SOURCE Office of Technology Assessment

depths are *46.5* ft, and the two tandem dumpers are capable of dumping four hopper cars, feeding loaders at a rate of 8,000 tonnes/hr.

Pier 5 is the smaller facility, consisting of one fixed electric car dumper with a capacity to handle fifty 70-tonne cars per hour. Pier 5 is used less regularly than pier 6 due in part to the limiting 35-ft alongside depths.

The Chesapeake & Ohio Railroad (C&O) facilities are located in Newport News at piers 14 and 15. Pier 14 supports two electric-traveling loading towers with stated capacity of *6,000* tonnes/hr. Pier *15* reopened on August 1, 1980, after 4 years of dormancy due to the surge in export steam coal demand. Channel depths are 45 ft for pier 14 and 38 ft for pier 15. Demonstrating the unprecedented demand in steam coal exports, the C&O's export level increased dramatically from *400,000* tonnes in 1979 to 4.5-mmt in the first 6 months of 1980 alone.

A number of new projects have been proposed for increasing the capacity of Hampton Roads to handle export requirements. One proposal calls for a 300-acre" coal facility operated jointly by several coal companies led by Cox Enterprises and including A. T. Massey, Pitt-

ston Coal Export Co., Island Creek Coal Sales Consolidation Coal Co., Westmoreland Coal Co., and United Coal Co.

The facility would be designed to have a 20-mmt/yr capacity and cost between $60 million to $100 million. This project has run into legal trouble with N&W, claiming it is still the rightful owner of the land. The land had been sold by N&W to Trailsend Land Co., and Hampton Roads Energy Co., a subsidiary of Cox Enterprises with a proviso that an oil refinery would be built on the site. Six years have elapsed since the 1974 sale, and according to N&W attorneys, the property should revert back to them. This issue has not been resolved. The Commonwealth of Virginia has also proposed to purchase this land and construct a State owned and operated coal terminal. However, the City of Portsmouth is opposed to such State ownership because it would reduce their tax base.

A second proposal involves pier *9* at Newport News which was sold by Chessie Railroad to A. T. Massey Coal Co. Massey plans to build a $60 million coal storage and shipment terminal. Pier 9 is adjacent to the pier 14 and 15 facilities owned and operated by C&O. The sale included an adjacent 60-acre parcel of land where **a** rail and conveyor system, plus ground storage area capable of holding 1.5 mmt of coal will be located.

The final development at the Port of Hampton Roads was the sale of *72* acres of land to four coal-producing firms. The land is located between C&O's pier 14 and Massey's pier *9* at Newport News. Though no confirmation has been received, Sprague Coal International, a division of Westmoreland Coal, is believed to be involved. No details of project scale, cost, or scheduling have been released.

Port of Baltimore

At the Port of Baltimore, two of three former coal piers are currently in operation loading vessels for export, and several major development projects are underway. The port's largest coal export facility is located in the Curtis Bay area of the harbor, and is owned and operated by the Baltimore & Ohio (B&O) Railroad (figure *6).* Since Baltimore is equipped with only one major facility, many vessels are known to remain anchored for up to 1 month and more. And though the vessel waiting lines for the port's coal piers are not as long as that of Hampton Roads, the waiting time can be longer. It is believed that the shortage of close-in anchorage areas, and constricted approach to Curtis Bay has additionally led to increased delays.

The B&O railroad has begun to reduce the 40-to-45-day wait by barging coal to waiting vessels at its Port Covington ore pier from Curtis Bay.

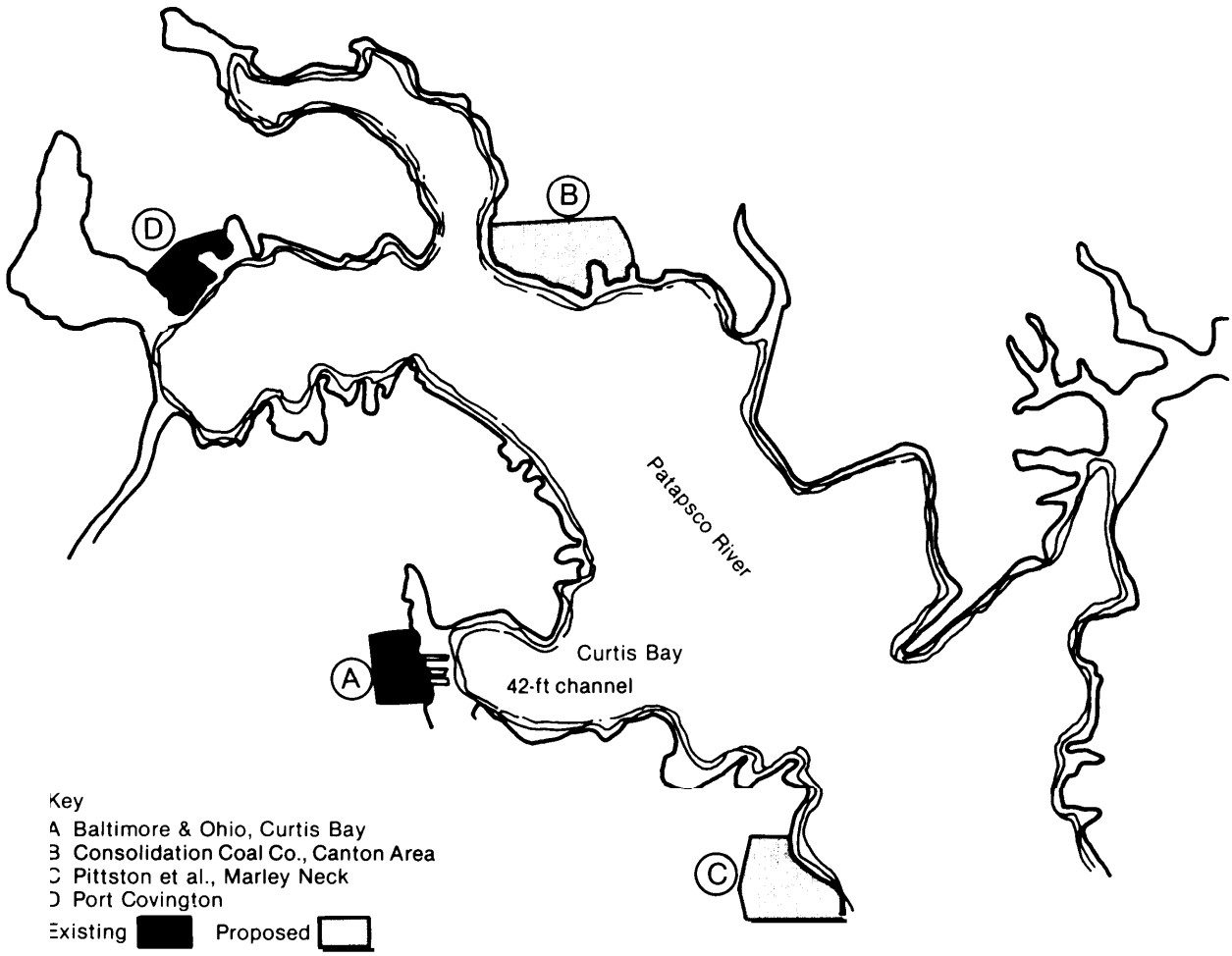
The procedure involves a grab-bucket operation that is capable of loading an average 50,000-tonne coal ship in about 3 days. Coal is initially loaded onto barges at the underutilized barge side of the Curtis Bay terminal. The barges are then towed north to Port Covington.

From a physical facility standpoint, several specific proposals have been made for the Port of Baltimore. First, the Island Creek Coal Co., a subsidiary of Occidental Petroleum Corp., and the leading coal exporter from the Curtis Bay pier, has committed *$40* million to develop a 25-acre coal-stocking yard adjacent to the existing coal pier. The development of the yard, and the installation of coal-dumping machinery is scheduled to be completed by September 1981.

The yard will have a storage capacity of between *300,000* to *500,000* tonnes, depending on the mixing requirements for different grades of coal. New equipment will include rail tracks, scales, reclaimers, conveyor equipment, and dumping machinery. All construction will control dust movement through several spray systems. The Baltimore City Council has been presented with a proposal to help finance the Island Creek project by issuing industrial development bonds.

A second major terminal improvement has been advanced by Consolidation Coal Co.(Con-Sol), a subsidiary of Continental Oil Co., to buy the old Canton Marine Terminal for *$30* million, including the local switching railroad owned by the Canton Co. A low-interest rate

Figure 6.— Existing and Proposed Coal Piers, Port of Baltimore



SOURCE Office of Technology Assessment

Baltimore City bond has been approved to assist the Consolidation effort.

The facility will have an on-the-ground storage capacity of 750,000 tonnes and will be able to accommodate 100,000 car arrivals annually. It has an open conveyor system, thawing sheds, a dual-car rotary dumper, and an extensive antidust spraying system.

Initially, the ConSol pier will load 10 mmt and service 175 to *200* ships annually. An existing pier now used to discharge ore will be extensively redeveloped and transformed into a coal-loading facility. Plans call for the pier to load ships on one side and barges on the other. Total investment for the first phase is $110 million, including the land purchase.

ConSol is leaving the option open of expanding the pier's loading capacity to 20 mmt/yr. Whether or not this second phase of development takes place will largely depend on the future coal market and the dredging of the channel.

ConSol has set a target date of the first quarter of 1983 for completion of the storage and pier facility. Advanced engineering draw-

ings have been completed and ConSol is moving in the permit process.

A third and largest project involves a 500-acre tract sold by CSX Resources, Inc., to Soros Associates. The site is located in the Marley Neck area of northern Anne Arundel County, not far from the Curtis Bay facility. A consortium of five major coal producers have pooled financial resources to develop the 15 mmt/yr capacity for *$270* million. The coal producers are Pittston Co.; Mapco Co.; Elk River Resources, a subsidiary of Sunoco; Old Ben Coal Co., a subsidiary of Sohio; and Utah International, Inc., a subsidiary of General Electric.

The design of this facility is unique in the sense that a 6,000-ft trestle will be constructed over the shallow areas of the Patapsco River. Cost considerations and potential problems with dredge-spoil disposal areas prompted Soros to select the offshore loading procedures rather than pier-side operation. Operational startup is scheduled for early 1985.

Port of Philadelphia

The Port of Philadelphia is currently served by one active coal terminal. Pier 124 is located on Greenwich Point on the Delaware River near the Philadelphia naval yards. The pier is owned and operated by Conrail, and can accommodate vessels on the south side of the pier. It is equipped with two rotary car dumpers and mechanical conveyors, telescopic chutes, and trimmers. Barges can be loaded on the north side of the pier. It is serviced by a 40-ft channel.

Development plans are underway to upgrade the pier so that two vessels can be loaded simultaneously. Capacity has been stated as reaching 3 mmt/yr after phase I development, and potentially 10 mmt/yr if all development plans are completed. This project will help to increase the pier's handling capacity of vessels from 40,000 to 80,000 deadweight tonnes.

In addition to the Greenwich Pier, Conrail has recently completed the rehabilitation of 230 miles of rail trackage between Philadelphia and the Clearfield, Pa. coalyards. A total of *$60* million is being spent for *1,550* open-hopper cars, and the refurbishment of *17,000* older vehicles.

An unused facility is located at Port Richmond's pier 18. Should interest be sufficient to reactivate it, complete renovation including a new pier, dredging, and all required equipment would be needed.

The Delaware & Hudson Railroad serves the Port Richmond area and has reportedly been pursuing trackage rights for access to the terminal from the Southeastern Pennsylvania Transportation Authority.

A third development site under consideration is located at the site of the Northern Shipping Co. marine terminal north of downtown. The 162-acre tract is presently used for general- purpose stevedoring activity, but could be reconfigured for coal export. Preliminary data indicates that the new terminal could handle up to *6,000* tonne/hr., employing unit trains. If the new terminal is developed at Northern Shipping, the existing stevedoring activity would be relocated to an adjacent site.

Port of Mobile

The Port of Mobile is located in the southwestern part of Alabama, at the junction of the Mobile River and the head of Mobile Bay. The port is about *28* nautical miles north of the bay entrance from the Gulf of Mexico, and *170* nautical miles west of New Orleans. The port's principal waterfront facilities are located along the lower 5 miles of the Mobile River.

The outer harbor of Mobile consists of the deepwater channel extending from the mouth of the Mobile River. From the upper reach of the Mobile Bay channel, the Arlington channel leads northwestward to a turning basin at the southwest end of Garrows Bend. Garrows Bend channel leads northeastward from the turning basin, and terminates south of the causeway connecting McDuffie Island with the the mainland. McDuffie Island is just west of the Mobile Bay channel at the mouth of the Mobile River, and is the location of all coal exporting activities.

McDuffie Terminal is recognized as one of the most modern coal-handling facility in the world. At the present time, most of the coal is being mined in the north Alabama fields and shipped by barge to McDuffie for export. A small amount is being transported by rail for export. It is owned and operated by the Alabama State Docks Department, the only domestic coal-handling facility involving direct public interest. It was placed into operation in January 1975, incorporating the newest and most innovative approaches to material handling and automatic barge unloading in the United States.

McDuffie Island is accessible from the mainland by a causeway and is served by the Terminal Railway of the Alabama State Docks Department. The island is adjoined on three sides by dedicated channels. The Mobile River channel on the east side is presently authorized and maintained to a depth of *40* ft. The Arlington channel on the south side is authorized and maintained to a depth of *27* ft, and the Garrows Bend channel is authorized to a depth of **27** ft, but has not been maintained since the construction of the causeway at the north end of the island.

The fact that McDuffie Island is south of the 44-ft-deep channel crossings of Interstate Highway 10 and Bankhead Tunnels, places the facility in the advantageous position for the future handling of much larger bulk carriers if a plan for deepening the Mobile ship channel to the gulf is approved to increase the present authorized depth of **40** ft to a depth of 55 ft.

The initial facilities constructed on McDuffie Island included an automatic barge unloader, railcar dump, truck dump, two storage pads, a stacker/reclaimer and material handling conveyor system, ship dock, ship loader, offices and control tower as well as backup maintenance buildings, and receiving tracks for railcars. Expansion facilities will include an additional barge unloader, additional stacker/-reclaimer, two additional storage pads, the construction of a loop track for handling of unit trains of coal, and an integrated conveyor system.

The barges are brought into the fleeting area and moored by various towing companies that also remove the empty barges from the fleeting area (fig. 7). Movement of the barges within the fleeting area is accomplished by a workboat under contract to the various shipppers. The barges are presently unloaded by a high-capacity ladder-type bucket-elevator unloader. The bucket elevator remains stationary while the barge is moved back and forth beneath it to allow the unloader to remove the coal and place it on the conveyor system. The new barge unloader will be of similar design.

The open-storage area has a capacity of *430,000* tonnes. The electric-traveling stacker-reclaimer has a 180-ft boom equipped with a reversible 72-inch belt conveyor and a continuous bucket wheel. It has a stacking rate of 4,000 tonne/hr, and a reclaiming rate of 5,000 tonne/ hr.

By May 1981, the second phase of development should be complete, adding a second stacker/reclaimer, two additional storage pads, one more barge unloader, and a rail facility which will accommodate unit trains in a loop-track setup. Total price of $20 million is estimated to complete this work.

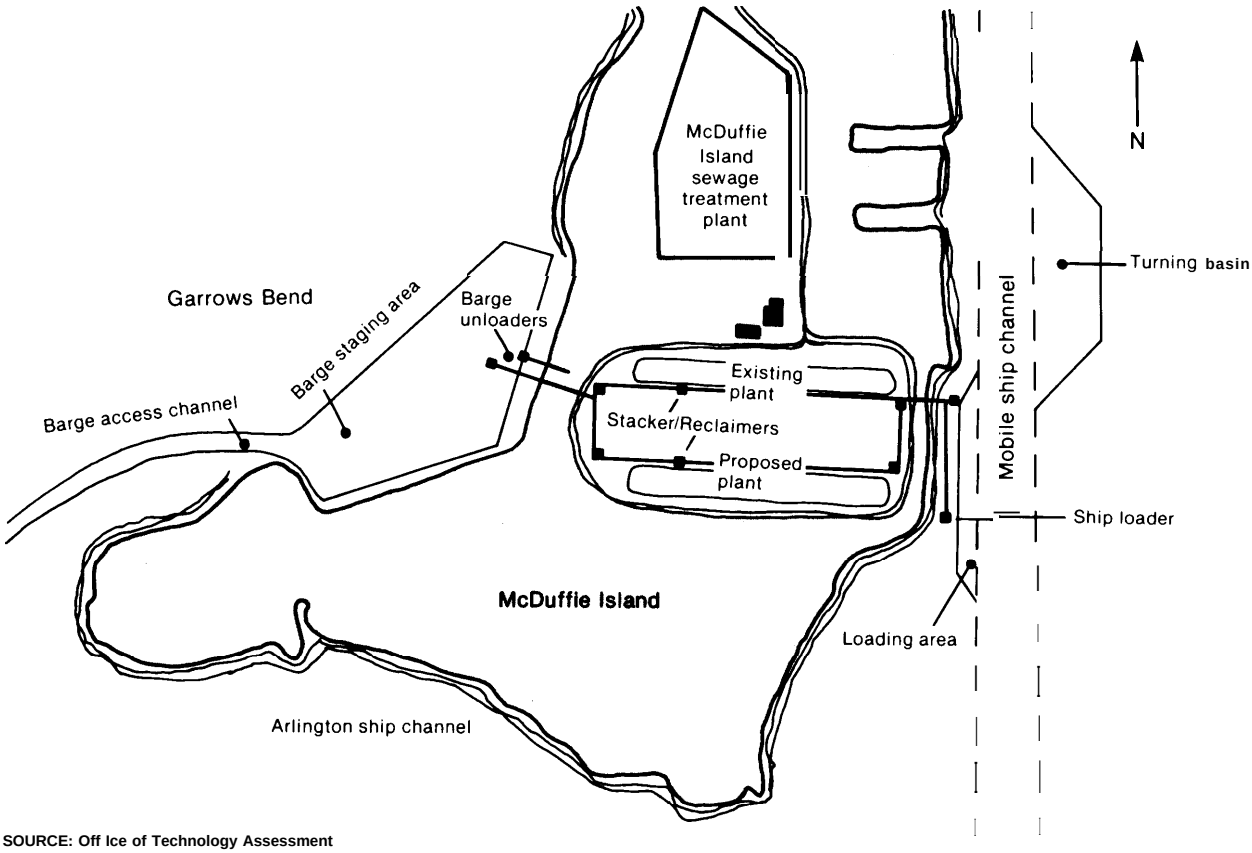
Phase III development will include a new dock, shiploaders, and a third stacker/reclaimer for approximately $30 million to $35 million. To allow for the second and third phases of development, a 143-acre site was recently acquired by the State, immediately adjacent to the existing complex. The new area includes 2,800 ft of riverfront berthing space.

Port of New Orleans

The Port of New Orleans currently handles coal for export at two terminals located in Plaquemines Parish' (fig. 8), Coal exports were first handled in 1978 at the International Marine Terminals, Inc. (IMT) facility, located 50-miles

[b]Based **in** part on comments provided by Colonel Herbert R. Harr, Jr., Associate Port Director, Board of Commissioners of the Port of New Orleans, before the Energy Bureau, **Inc. 's, "Coal Export Conference," Washington, D. C.,** Dec. 15 and 16, 1980.

Figure 7.—Physical Layout, McDuffie Island



SOURCE: Off Ice of Technology Assessment

below New Orleans. Expansion to 12 mmt/yr by 1985, and up to 25 mmt/yr by 1990 has been proposed. The terminal currently accommodates shallow draft, open-hopper river barges unloaded by a continuous unloader with a capacity of *5,500* tonne/ hr. A 270,0()()-tonne ground storage area is available. Reclaiming of coal occurs via dozer at an average rate of 1,000 tonne/ hr.

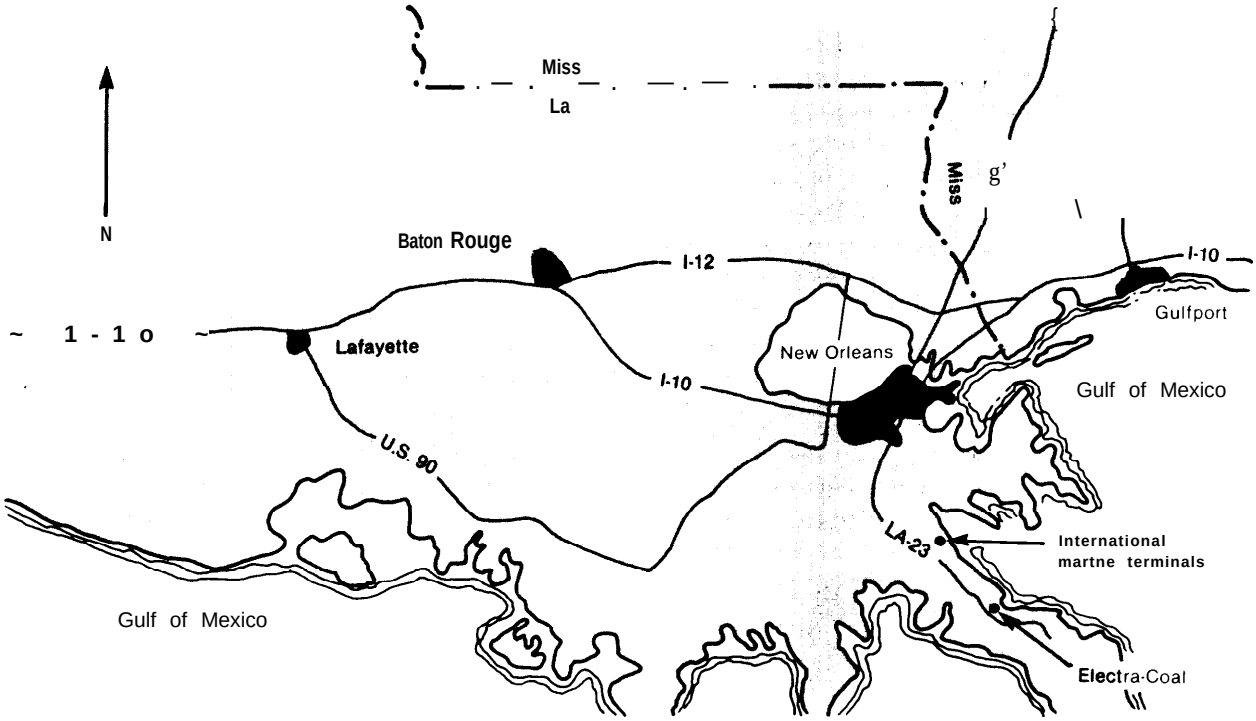
Phase II calls for the addition of a new dock and installation of a traveling ship unloader having an ultimate capacity of *7,000* tonne/hr. In phase III a stacker/reclaimer is scheduled to be used at full development and nearly 1 mmt of active storage area will be available. The IMT officials have indicated that it is their hope that *5* or *6* large-volume customers will require the greatest share of coal.

The second export facility in operation in the New Orleans area is the Electro-Coal Transfer Terminal. Electro-Coal is expanding its capacity with a *$200* million, two-phase program. The expansion will allow them to handle *25* mmt/yr by 1990.

In addition to the existing facilities, several other proposals have been made for new export terminals. Near Baton Rouge, the River & Gulf Transportation Co. has acquired almost *600* acres of land for an export terminal capable of handling 11 mmt/yr of coal and 5 mmt/yr of iron ore by 1985. A subsequent phase calls for a 15-mmt/yr-coal exporting capacity by 1990.

The ability of the Mississippi River to transport large volumes of coal has been the direct stimulus of the interest in gulf coast ports.

Figure 8.— Existing Coal Terminals, Port of New Orleans



SOURCE Off Ice of Technology Assessment

Several major inland waterway barge carriers have recognized this by investing $55 million in modern rail-to-water transfer facilities capable of handling *30* mmt/yr. The American Commercial Barge Line and Federal Barge are currently transporting large volumes of coal along the Mississippi River coming from States bordering on the upper Mississippi and its tributaries.

The influence of the French Government is strongly felt in the New Orleans area for coal export. The Association Technique de L'Importation Charbonnierc (ATIC) is sole agency in France responsible for importing the large quantities of foreign coal needed to replace oil. ATIC is currently acting as agent for the Spanish and Netherlands Governments, as well as coordinating efforts for West Germany. The aim of ATIC is to negotiate long-term contracts with coal suppliers in nations with stable governments. Their interest does not stop at the purchase of coal but extends to the transportation and shipment. To be assured of a smooth flow, ATIC will obtain a participating interest in barge companies and in coal export terminals.

Terminals on the lower Mississippi River are capable of being served by both barge and rail. The Illinois Central Gulf Railroad is investing heavily in improvement of their trackage to New Orleans in anticipation of unit train movements of coal to and from the Illinois coalfields. This competition with the barge lines should limit increases in transportation costs such as have occurred in Western areas where only one mode of transportation is available.

COAL PROJECTS AT OTHER PORTS

A number of significant proposals have been made for constructing, or at least investigating the feasibility of constructing new terminals at ports which have not historically exported coal. Virtually all possible locations have been considered, ranging geographically from ports on the Great Lakes, to New York, Jacksonville, Long Beach, and Puget Sound. The following text is based on accounts provided in reports, newspaper articles, magazines, etc. Due to the confidential nature of new projects, many details never are presented publicly and analysis must remain somewhat superficial. Nonetheless, by assembling information from a number of sources, a reasonable description can often be made of likely coal export terminal development patterns.

The likelihood is remote that all of the proposed projects will be developed. Many industry observers have voiced the concern of overdevelopment of capacity and unwarranted expenditure. As the export situation continues to evolve, the feasibility of new proposals will become more evident and coal companies and railroad executives will be better able to evaluate the risk and return on investments. Many experts seem to agree that free marketplace demands will dictate the suitability of one proposal v. another, and that the Federal Government should not try to outguess business decisions.

Great Lakes Ports

The U.S. Great Lakes coal-loading port facilities are generally railroad-owned and have historically served the U.S. domestic and American-Canadian coal trade'. In 1979, total annual tonnage amounted to about $41.5 mmt, of which *23.5* mmt were domestic movements (e.g., Duluth-Superior to Detroit), and *18.0* mmt were exported to Canada. The domestic trade is served by U.S.-flag bulk vessels. Canadian bulk vessels generally handle the export tonnage.

'Department of Commerce, Maritime Administration, Great Lakes Region, *Great Lakes Ports Coal Handling Capacity and Export* Coal *Potential,* December 1980.

A recent U.S. Maritime Administration study analyzed a four-ship feeder service from Conneaut, Ohio to Quebec. This system would deliver coal to Quebec at a price of approximately $56.65/tonne. This price was believed reasonably competitive with *$51.00* to $55.00/ton price at Hampton Roads, Baltimore, or Philadelphia, which are served by rail.

There are currently seven U.S. ports on the Great Lakes that have the capability to handle shipments of coal for either export or domestic use. They are:

- Ashtabula, Ohio,
- Conneaut, Ohio,
- Erie, Pa.,
- Sandusky, Ohio,
- South Chicago, Ill.,
- Superior, Wis., and
- Toledo, Ohio.

The ports of Erie and Conneaut both began shipping domestic steam coal for overseas exports in 1980 and their activity is expected to continue.

Ashtabula, Ohio.—Currently handles both steam and metallurgical coal for export to Canada and domestic use. Approximately 75 to 80 percent is steam coal for Canadian markets. The facility is being modernized and utilizes a 7,000-tonne/hr conveyor system for loading vessels. Ground storage is 1.5 mmt and approximately 500 railcars can be stored onsite. There is no blending capability and there are no plans for expansion at the present time. A new stacker/reclaimer is planned for 1981.

Conneaut, Ohio.—This is a modern facility that also was the first to ship coal for export to Europe through a Canadian transshipment facility (Quebec City). An estimated 150,000 tonnes of steam coal has moved from Conneaut during 1980. The facility does provide a blending service. A conveyor system capable of 7,700 tonne/hr loads coal into vessels from a 6-mmt ground storage area. The facility has the capability to increase shipment tonnage without any improvements. There are no plans for expansion in the near future.

Erie, Pa.—Presently a temporary facility is being used at the port to ship steam coal for domestic use. These coal shipments were initiated in 1980 on a trial basis and 1981 plans indicate an increase in tonnage shipped. The temporary facility is receiving coal by truck from western Pennsylvania mines and has a ground storage capacity of 20,000 tonnes. Vessels are loaded by conveyor and there is no blending capability. The Erie-Western Pennsylvania Port Authority has received $95,000 from the Commonwealth of Pennsylvania to perform a marketing feasibility and land-use study for a permanent coal-loading facility. This study will be completed in 1981. Additionally, Pennsylvania has passed legislation to secure bonding power for up to $10 million for development of a permanent facility. The results of the study will determine when this development will commence and to what degree.

Sandusky, Ohio.—Coal shipments consist of s55 percent for export to Canada and 45 percent for U.S. domestic users, Approximately 65 to 70 percent is metallurgical coal with the balance being steam coal. The facility uses a *3,500*-tonne/hr car dumper for vessel loading and can stage approximately 2,800 railcars. Blending can be accomplished through mixing of railcars. A ground storage capacity of $950,000 tonnes is also available. This facility is presently dedicated to contract customers. Future expansion is not planned at the present time.

South Chicago, Ill.—This facility has only handled shipments of coke to both Canadian and U.S. domestic customers, although the capability and capacity to ship coal is present. A 5,00@ tonne/hr-loading rate by two traveling towers provides rapid offloading of railcars. A 1,500-car capacity is available on the site. Barges can also be loaded. Through the mixing of railcars, blending could be accomplished. Expansion for coal handling can be accomplished on the present 40-acre site with little capital cost.

Superior, Wis.—Currently, Western steam coal for the U.S. domestic market is handled at this facility, which is less than 5 years old. Railcars are immediately dumped and material is placed into either ground storage or loaded directly onto vessels via an extensive conveyor system. Ground storage capacity is currently 7 mmt and initial design plans allowed for 12 mmt. However, expansion to this capacity will require additional capital investment and is not planned in the near future. The loading rate of *8,500* tonne/hr by conveyor is the fastest on the Great Lakes. Blending can be accomplished by controlling the underground reclaimer plow feeders if required. Vessel size is limited to seaway-size vessels.

Toledo, **Ohio.**—There are four separate loading berths at the facility. Coal shipments are 60-percent-steam and 40-percent-metallurgical coal and are primarily destined for the U.S. domestic market with only some shipments to Canada. One berth (east pier No. 4), uses a 4,500-tonne/hr" conveyor for vessel loading. The other three berths use an 1,800-tonne/hr car dumper. Berth east side No. 1 has not been used for the past 8 years although it can be operated if needed. These three berths are limited to seaway-size vessels. The facility does not have any ground storage capacity but can accommodate approximately 5,000 railcars. Blending can be accomplished through mixing of railcars. Currently, there are no plans for future expansion. If demand requires, the inactive berth can be operational with little, if any, capital investment. In 1965 and 1966, Toledo moved 34.8 mmt and 34.3 mmt.

Port of New York

Several proposals have been presented for developing coal-export handling facilities at the Port of New York. The two major proposals center on Arthur Kill and the Ambrose Channel of the lower Hudson River. The Arthur Kill project is a short-term solution designed to divert some of the coal activity to New York from Hampton Roads and Baltimore. The plan calls for transporting coal to Conrail's Port Reading coal pier and loading it on barges. The barges would then be moved to a deepwater pier where the **coal** would be transshipped to ocean vessels.

Port Reading is located on Arthur Kill, the narrow body of water between New Jersey and Staten Island. The channel depths at that point

are too limiting to allow large-draft vessels to enter, and therefore the barges must be used.

To accommodate demand by the mid-1980's the Port Authority of New York and New Jersey has been considering a number of sites including a point near Stapleton, which is south of St. George on Staten Island, Greenville in Jersey City, or along the Ambrose Channel.

Ports of North Carolina and South Carolina

The North Carolina State Ports Authority has advanced discussions and plans for one export terminal at one of several locations including Morehead City or Wilmington. Discussions have been held with several coal companies investigating the feasibility of a 3-mmt to 8-mmt tonne/yr terminal. The Seaboard Coast Line Railroad (now part of the CSX system) serves the Port of Wilmington, and has expressed its willingness to haul coal. Southern Railroad (soon to merge with Norfolk& Western), which serves Morehead City, has not actively pursued coal terminal development, although they would be willing to haul it.

The South Carolina State Ports Authority has pursued the development of a coal-exporting facility, with the most probable location being Charleston. Southern Railway serves Charleston and is considering the merits of possible investment. A. T. Massey has expressed firm plans to begin construction on a $75 million terminal at Charleston, capable of handling 12 mmt/yr. Massey has arranged for the purchase of a 55-acre site from Burris Chemical Co., located between North Charleston and Columbus Street Terminals of the South Carolina State Ports Authority. To assist in the finance, the Charleston County Council has expressed a willingness to release a $75-million industrial revenue bond issue.

Rail service to the Charleston site would be provided by a combination of Southern, Seaboard Coast Lines, and Louisville and Nashville railroads. Approval has already been obtained for channel-deepening from 35 to 40 ft. Yet, since the Corps of Engineers is completing a study to redivert silt buildup in a feeder river, dredging must wait. When the rediversion project is completed, dredging could follow with completion expected in the 1985-86 time frame.

Ports in Georgia

The earliest commitment for a new export facility at U.S. South Atlantic ports came from the Port of Savannah. A 12-mmt to 15-mmt/yr terminal was announced on September 22, 1980, with an attached price of $50 to $60 million on the 250-acre Hutchinson Island site. Coal is scheduled to be transported over Louisville and Nashville, and Clinchfield Railroads from mines in Kentucky and southwest Virginia. The coal will also move over Seaboard Coast Line trackage beginning at Spartanburg, S.C. Savannah has channel depths of 38 ft, plus a 7-ft tide, considered adequate for coal vessels. In addition, the Corps of Engineers is now evaluating the deepening of the channel to 42 ft.

In addition to Savannah, preliminary plans have been developed calling for a 15-mmt/yr capacity (2.3 mmt/yr initially) terminal in Brunswick, Ga. to be constructed as soon as the channel leading to the site can be dredged beyond its current 30-ft depth to 36 ft. In light of the Savannah commitment, the potential development for this terminal seems less likely. The 1985 time frame has been identified as a target date for full operations. The terminal would be located on 100 acres of Colonel's Island and be equipped with a full stacker/reclaimer system. The island is connected to branch lines of Seaboard Coast Line Railroad and Southern Railroad by a 21.7-mile hookup.

Port of Jacksonville

Consideration is being given to utilizing the regional coal transshipment facilities being studied for Blount Island as a coal-export terminal. The Jacksonville Electric Authority (JEA) and other Florida-based utility companies are evaluating the feasibility of a coal-unloading terminal for regional electricity production. Individuals familiar with the project indicate that the utility companies do not want to eliminate the possibilities of using the new receiving terminal as an export point as well.

Ports in Texas

In the State of Texas, primary attention is focused at Galveston and Houston for coal-export facilities. The Pelican Island Terminal at Galveston is being coordinated by Orba Corp., which leased needed land from the port approximately 5 years ago. Ninety-six acres are proposed for near-term development with 76 acres as backup expansion area. A 15-mmt/yr terminal is planned under full development schemes, to be equipped with 2,600 ft of berthing space, and a 56-ft channel. The final approval for channel-deepening is expected this summer. The 56-ft channel depth is believed to support the sailing fees of up to an additional 2 days as compared to the use of east coast ports. Excellent rail service is provided by the Burlington Northern, Missouri Pacific, Southern Pacific, and Santa Fe railroads.

The neighboring Port of Houston has advanced development plans for an export terminal on the Houston ship channel, adjacent to the port's Green Bayou bulk-material handling plant. Thirty-two acres have been leased to Soros Associates for development of the facility.

California Coast Ports

Port officials at California cities are optimistic over the prospects for exporting Western States mined coal through their facilities. Most notably, the Ports of Los Angeles, Long Beach, Sacramento, and Stockton have presented the strongest arguments for using their facilities. Currently, only limited coal is being shipped to California ports for export on experimental runs. In general, the costs of using rail transportation to move coal across the Rocky Mountains from the mines requires considerably higher rates than the use of Eastern coal terminals, despite the waiting lines and demurrage fees. Also, environmental opposition to increased unit train movement is expected to delay rapid project implementation.

The Port of Sacramento is being given consideration as a result of it being the closest port in railroad mileage from major Western coalfields. Sacramento additionally offers large areas for open storage and its rail-yard system is known to be considerably less congested than other California ports. Sacramento suffers from having only limited 30-ft-deep approach channels, but port officials maintain that the shorter rail distance counterbalances the need to use small draft vessels.

The Port of Stockton has handled coal in the past and is evaluating interest in constructing a major export terminal. Located 75 miles east of San Francisco, possessing channel depths of 35 ft, rail access, and required land area. Port officials in Stockton believe they have a very likely site. Plans call for developing a storage area capable of holding 100,000 tonnes. This area would be combined with an existing 40-car-per-8-hour shift dump facility, conveyor belt system, and potential for a circular unit train track.

At the Ports of Long Beach and Los Angeles, some limited rail deliveries have been made for final delivery to Japan, Taiwan, and South Korea. Mines located in Utah and Colorado have provided the coal.

The Port of Los Angeles has capacity for up to 1.5 mmt/yr as currently configured. The 51-ft channel depth, and storage area capable of holding 100,000 tonnes, stand ready for increased service. Long Beach also has a deep channel at 40 to 48 ft, and could handle up to 2.0 mmt/yr. Both Long Beach and Los Angeles have announced plans to expand coal-export capabilities there. Long Beach plans to modernize its existing terminal and build a new one which would have a 30-mmt/yr capacity by 1985. Los Angeles has announced approval of planning for a 20-mmt terminal.

Pacific Northwest Ports

Ports in the Pacific Northwest States appear to be advancing more rapidly than California ports in developing coal-export facilities. Interest is highest at Portland, Oreg., and Kalama, Wash. Officials at Portland are in the process of seeking bids to begin work on a multiphased export terminal with proposed final design capacity of 10 mmt to 12 mmt/yr. A $30-million first stage is contemplated with startup by late 1982 or early 1983 expected. The 100-

acre site is to be located on the Willamette River, approximately 100 miles upstream from the Pacific Ocean on a 40-ft deep channel. Rail service provided by three carriers will allow for dramatic expansion beyond the 200,000 tonnes handled in 1980.

The Port of Kalama, Wash. has unveiled plans to build a $50 million to $60 million coal port on a 200-acre site of the Columbia River. The Honolulu-based firm of Pacific Resources, Inc. (PRI) is to lease the land from the port following completion of the sale from Burlington Northern. Coal will be brought to Kalama on Burlington Northern and Union Pacific main rail lines from Rocky Mountain States.

Pacific Resource is expected to design the terminal to handle 15 mmt/yr, but initial development will be on a smaller scale. The facility will be able to accommodate mile-long unit trains in two circular rail tracks to be emptied into a hopper below the tracks.

Port officials at Bellingham, Wash., announced plans in November of *1980* to develop a $50-million bulk terminal designed to handle coal and other commodities. The proposed site is located on land previously dedicated to an oil terminal. However, there is community opposition to this proposal, and final designs have not been made.

A *$50* million, 215-acre site is being evaluated on the Skipanun River at the Port of Astoria, Oreg. Preliminary design plans call for a 5-mmt/yr capacity but upgrading of Burlington Northern rail trackage to the site is a must.

A final major prospect comes from the Port of Bellingham, Wash., approximately 100 miles north of Seattle. Port officials are quick to point out that only Bellingham can accommodate 250,000-tonne tankers due to its deep-draft harbor.

SUMMARY OF COAL PORT PROJECTS

Figure *9* summarizes the approximate scheduling of new projects as discussed above. As indicated, and as experience would dictate, the proposed projects possessing the shortest start-up times are located at ports already handling coal. Definite commitments have been obtained by six seaboard port areas, as well as from Great Lake ports. The longest buildout periods are projected for ports which do not currently export coal, and which do not have firm commitments from coal companies, railroads, and investment houses.

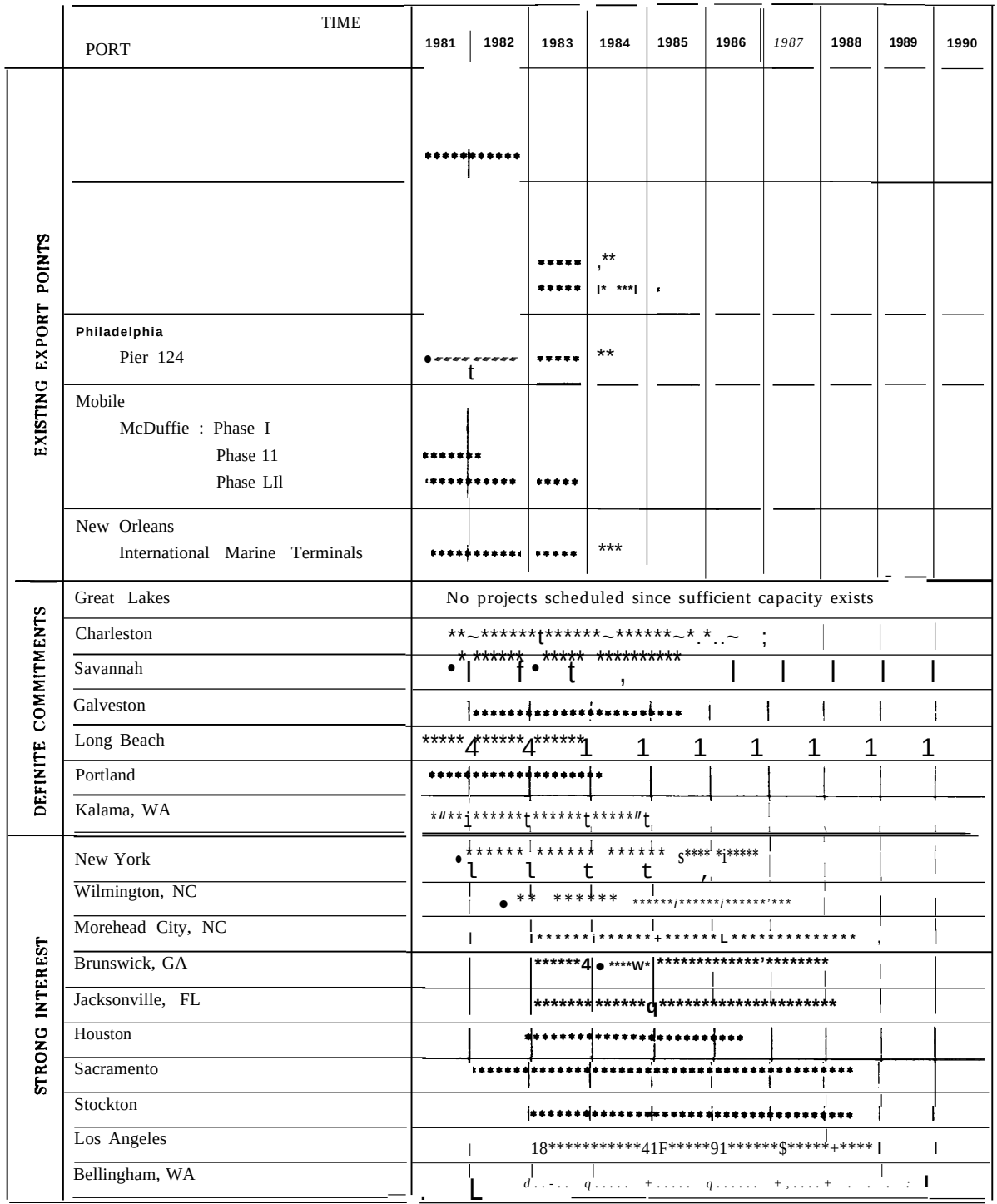
SHIPS IN THE COAL EXPORT TRADE

Coal is transported from U.S. ports and terminals to Europe, Japan, and other countries aboard large bulk ships ranging in carrying capacity from 10,000 to over 100,000 tonnes.

There is considerable changing character to the ships in the coal export trade. Prior to *1965*, the conventional ship with a deadweight tonnage (dwt) of 15,000 tonnes tended to dominate the trade, This domination disappeared with the advent of the large bulk carriers and the combination, oil-bulk-ore, carriers. The bulk carriers are suitable for carrrying a number of dry bulk cargoes such as grain, coal, phosphate, bauxite, and other ores. Thus, there are many ships that can move into and out of the coal trade. This versatility with respect to all commodities is necessary where there are surges and changes in the trade. In the past two decades the dry-bulk fleet has increased from 10-million-dwt to over 150-million-dwt capacity. In recent years the greater use of larger ships in the World and North American coal trades is summarized in table *6.*

The ships available to trade between specific ports, are dependent on three factors: the exporting port's channel depths, the importing

Figure 9.—Approximate Implementation Schedule of New Coal-Export Terminals



Note: Time periods are estimated for the "Definite Commitments.[v] and 'Strong Interest" sections.

SOURCE Office of Technology Assessment

Table 6.—Size Distribution of World Coal Fleet (deadweight tons)

	Less than 40,000	40,000-59,999	60,000-79,999	80,000-99,999	100,000 & over
World Coal trade by vessel size					
1974	**45%**	**28%**	**19%**	**2%**	**6%**
1979	**35%**	**15%**	**20%**	**4%**	**260/o**
North American coal exports by vessel size					
1974	**26%**	**30%**	**30%**	**5%**	**9%**
1979	**19%**	**16%**	**27%.**	**6%**	**32%**

SOURCE: OSG Bulk Ships Inc., New York, February 1981.

port's channel depths, and the depths of canals traversed between the ports. The present U.S. major coal-loading ports and their present controlling channel depths are:

Hampton Roads	45 ft
Baltimore	42 ft
Philadelphia	40 ft
Mobile	40 ft
New Orleans	40 ft

The relationship between a ship's deadweight tonnage and draft, which relate to the channel depth restrictions, is approximate because of differences in hull form and length-to-beam ratios. However, a useful approximate relationship is given in table 7 along with limiting ship dimensions for traversing the Panama Canal.

Present worldwide coal exporting and importing facilities as related to deadweight tonnage is presented in tables *8* and *9*. The present world coal trade is transported in a fairly wide range of ship tonnages as a result of the various restraints and economic factors. Table 10 summarizes the range for 1979. The utilization of bulk and combined carriers by coal as compared to other cargoes is shown in table 11, indicating that coal accounts for approximately 18 percent of the tonnage carried. The makeup of the existing world fleet carrying these cargoes is shown in table 12 along with the present orders for new ships. New orders for bulk carriers indicates a continuing shift to larger ships.

Economics of Coal Ships

The selection of ships and routes is largely dependent on the economics of the transport and the availability of ships. Economies-of-scale are an important determinant of unit costs of coal transportation, these costs increase with distance and decrease with ship size. Three general sizes of coal carriers are noted below.

- *60,000* dwt.—This is roughly the median size for present coal shipments; it is also the maximum size which can pass fully loaded through both the Panama and Suez Canals at present. U.S. Flag cost per ton per day = $0.53. *
- 100,000 dwt.—This is roughly the average size of the largest long-distance coal shipments at present; it is also the maximum size for a number of coal ports now and in the future. U.S. Flag cost per ton per day = $0.40. *
- 150,000 dwt.—There are very few coal shipments of this size at present but it is estimated that it will be a common size on some journeys by 2000, many iron ore shipments are already of this size. U.S. Flag cost per ton per day = $0.32. *

Coal ships operate worldwide with complete mobility between trades. They can shift easily and rapidly from one dry-bulk commodity to another. Entry into and exit from the bulk- shipping business is completely unrestricted. The industry is unregulated, and the market where bulk-shipping services are bought and sold is large and well-developed. There is no significant differentiation in the provision of shipping services, and considerable price competition exists in bulk shipping. Therefore, the above costs are often quite different from actual prices of freight rates charged.

The overall trend in oceanborne coal transportation cost, as a function of ship size, is shown in figure 10. The unconstrained (op-

*Source: Maritime Administration, December 1980.

Table 7.—Dimensions of Selected Ships by Coal-Carrying Capacity

Coal-carrying capacity (dwt)	Overall length (ft)	Beam (ft)	Draft (ft)
40,000	630	105	35
60,000	760	105	40
100,000	910	116	48
150,000	980	133	56
200,000	1,020	150	62
Panama Canal limiting dimensions for transiting commercial ships	900	107	35'6"

SOURCE. Maritime Administration and Panama Canal Co.

Table 8.—Coal-Loading Facilities for Large Bulk Carriers Analyzed by Area and Capacity (number of facilities)

	Vessel classes by dwt							
Area	35,000-39,999	40,000-49,999	50,000-59,999	60,000-69,999	70,000-79,999	80,000-99,999	over 100,000	Total
United States	2	3	1	2	2	1	—	11
Canada	—	—	1	—	—	1	1	3
Australia	1	1	—	2	1	1	1	7
Poland	1	—	—	—	—	—	1	2
U.S.S.R.	1	—	—	—	—	—	—	1
South Africa	2	—	—	—	—	—	1	3
Other	—	—	1	1	—	—	—	2
Total world	7	4	3	5	3	3	4	29

SOURCE: H P Drewry (Shipping Consultants Ltd), *Ports and Terminals for Large Bulk Careers.*

Table 9.—Coal-Discharging Facilities for Large Bulk Carriers Analyzed by Area and Capacity (number of facilities)

	Vessel classes by dwt							
Area	35,000-39,999	40,000-49,999	50,000-59,999	60,000 - 69,999	70,000-79,999	80,000-99,999	over 100,000	Total
Scandinavia	—	2	–	—	—	—	—	2
EEC	2	5	7	2	7	3	3	29
Other Europe	1	1	—	—	1	1	1	5
Japan	2	6	2	2	2	2	10	26
South America	1	1	1	—	—	—	—	3
Other	2	3	1	—	—	—	—	6
Total world	8	18	11	4	10	6	14	71

SOURCE" H P Drewry (Shipping Consultants Ltd.), *Ports and Terminals for Large Bulk Carriers.*

timistic) case assumes no constraint on ship draft, i.e., that ships can be as deep as is required to minimize transportation costs. The constrained (realistic) case recognizes the realities of draft limitations in harbors.

As coal is a low-value commodity, savings in transportation costs are significant in the course of choosing between alternative sources of supply. Even though the ocean transportation cost of coal is very low when compared with that of other modes, it still adds between 20 and 35 percent to the cost of U.S. coal based on its value at the export port. Accordingly, both coal importers and exporters strive to control ocean transport costs.

Although prevailing spot-voyage freight rates are highly variable and receive considerable market attention, long-term vessel charter rates are established on the basis of full recovery of ship costs to the vessel owner. These costs include capital outlays, financing costs, etc. When operating costs (crew wages, insurance), fuel, and other costs (canal costs, port charges) are added to vessel capital costs; one obtains the

Table 10.—The World Coal Trade by Vessel Size, 1979

	Less than 40,000	40,000-59,999	60,000-79,999	80,000-99,999	100,000 & over
Exporting areas					
Eastern Europe	70%	16%	7%	3%	4%
Other Europe	62	8	15	11	4
North America	19	16	27	6	32
Australia	16	23	31	2	28
South Africa	26	7	9	5	53
Others	100	0	0	0	0
Importing areas					
United Kingdom Continental	30	9	20	5	36
Mediterranean	43	16	16	10	15
Other Europe	58	16	13	4	9
South America	27	33	24	1	15
Japan	24	16	23	3	34
Other	49	16	19	1	15
Totals	35%	15%	20%	4%	26%

SOURCE: OSG Bulk Ships Inc , New York, February 1981

Table 11 .—Shipments of Dry Bulk Commodities by Bulk and Combined Carriers[a]

	1974		1976		1978		1980 est.		1981 est.	
	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent
Millions of tons										
Iron ore	301	44.3%	276	37.8%	256	31.5%	290	31.7%	275	29.3%
Grain	88	12.9	125	17.1	151	18.6	165	18.0	170	18.1
Other	200	29.4	227	31.1	300	36.9	305	33.3	320	34.0
Subtotal	589	86.6	628	86.0	707	87.0	760	83.0	765	81.4
Coal	91	13.4	102	14.0	105	13.0	155	17.0	175	18.6
Total	680		730		812		915		940	
Billions of ton-miles										
Iron ore	1,483	42.8	1,389	37.6	1,284	31.4	1,460	30.7	1,400	28.3
Grain	529	15.2	696	18.8	865	21.1	1,010	21.2	1,070	21.7
Other	956	27.6	1,076	29.1	1,446	35.4	1,475	31.1	1.550	31.4
Subtotal	2,968	85.6	3,161	85.5	3,595	87.9	3,945	83.0	4,020	81.4
Coal	501	14.4	538	14.5	494	12.1	810	17.0	920	18.6
Total	3,469		3,699		4,089		4,755		4,940	

[a]Only includes shipments on vessels greater than 18,000 dwt. Capacity of the fleet between 10,000 and 18,000 totaled about 115 *million dwt In 1980.*

SOURCE OSG Bulk Ships, Inc , New York, February 1981.

total cost of ocean shipping. These long-term "equilibrium" costs, for various voyages and two ship sizes, are shown on table 13.

The economies of scale that are achievable with larger ships have become more important in affecting the future size distribution of the world shipping fleet because of the growth in trade between distant ports. The ocean transportation cost component is a significant portion of the total delivered cost of the coal in the trade between Europe and the United States and even greater when the exports are from Australia. The increasing cost of petroleum bunker fuel also makes shipping economies more important.

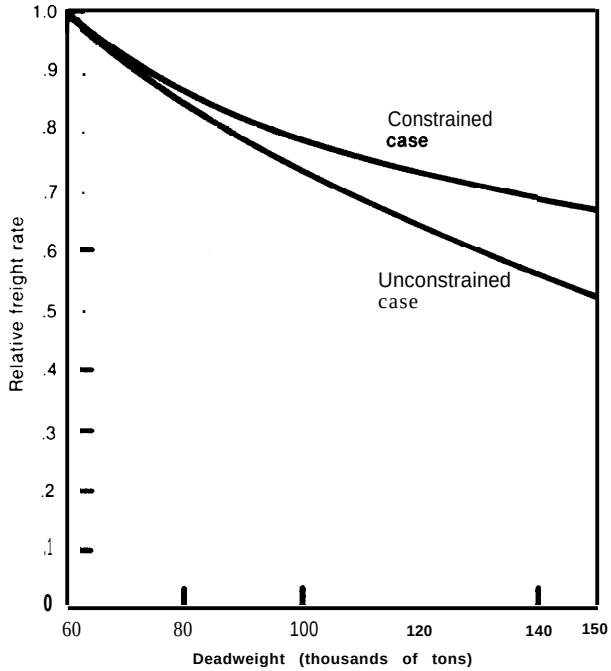
The increases in ship size would not have been practical without parallel development of port facilities capable of handling large vessels. The limits on ship size at U.S. ports, are about *80,000* dwt at Hampton Roads; smaller limits prevail elsewhere. Coal-loading facilities for ships of 100,000 dwt and over are located in Western Canada, Australia, and South Africa. Discharging terminals accessible to carriers in

Table 12.—The Existing Fleet and Tonnage on Order by Size Class (millions of dwt)

Size classes in dwt	Existing 1/81	On order 1/81	On order as percent of existing
Bulk carriers:			
10,000-39,999	**76.0**	**6.3**	**8.30/0**
40,000-59,999	**24.7**	**3.4**	**13.8**
60,000-79,999	**19.5**	**6.5**	**33.3**
80,000-99,999	**3.0**	**0.5**	**16.7**
100,000 & over	18.2	9.2	50.5
Total	141.4	26.0	18.40/0
Combination *carriers:*			
10,000 -59,999	1.8	0.2	11.1 0/0
60,000-79,999	5.2	1.1	21.2
80,000-99,999	4.8	0.3	6.3
100,000 & over	35.8	1.4	3.9
Total	47.6	3.1	6.5%

SOURCE OSG Bulk Ships, Inc , New York, February 1981

Figure 10.— Economies of Scale in Seaborne Coal Trade



SOURCES: IRan Hettena, In *Critical Issues in Coal Transportation Sysftems, 1979*

H Mellanby Lee, The Long Run Economics of the Ocean Transport of Coal, December 1978

Table 13.—Coal Shipping Costs for Round Trips From Selected U.S. Ports (assumes no demurrage charges)[a]

Coal loading port	Coal discharge port	Cost per tonne 60,000 dwt	Cost per tonne 110,000 dwt
Hampton Roads, Va.	Rotterdam, Netherlands	13.49	10.15
	Taranto, Italy	16.15	11.96
	Yokohama, Japan	31 .95[b]	34.57[c]
Mobile, Ala..	Rotterdam, Netherlands	16.70	12.32
	Taranto, Italy	19.36	14.13
	Yokohama, Japan	30.79[b]	35.35[c]
Portland, Oreg..	Yokahama, Japan	15.39	11.43

aThe above table of equilibrium coal shipping costs does not include the effect of demurrage (delay) charges As of this writing (February 1981), large numbers of ships are waiting to load coal at the U.S. east coast ports of Hampton Roads and Baltimore The delays associated with this average $600 per ton which is added to the cost of shipping U.S. coal overseas

[b]vla Panama Canal.
[c]via Strait of Magellan (South America)

SOURCE. ICF, Inc., October 1980

excess of 100,000 dwt exist in Western Europe and Japan, and more are planned.

Important constraints on ship size are imposed by the Panama Canal and, to a far lesser extent, by the Suez Canal. The draft and beam restrictions of the Panama Canal limit passage to ships of up to about 50,000- to 80,000 dwt; for this reason, ships in this dwt-range are commonly referred to as "Panamax" vessels. There are no plans at present for enlarging the Panama Canal.

Ships that are too large to pass through the canals must use the longer routes around the southern capes of South America and South Africa. Because of the greater voyage costs thereby incurred, it may be cheaper on particular routes to use a smaller vessel that can pass through the canal, in spite of the higher daily cost per tonne transported (including "canal dues" of about $2/tonne).

The expected growth in coal movements and achievable economies of scale will make large ships more common. It is expected that the number of ships exceeding 100,000 dwt will increase substantially, leaving a smaller portion of the coal fleet at 50,000 to 80,000 dwt for primary transit through the Panama Canal.

PROPOSED NEW TERMINAL AND SHIPPING SYSTEMS

Several types of new systems have been proposed for moving coal. Foremost are high-capacity terminals, slurry pipelines, and midstream transfer. Other proposals such as pneumatic-tubes, conveyor belts, barge-carrying ships, and shallow draft ships have received some attention as well.

In the long run, economics and large volume exports may force the introduction of new technologies to transport coal for export. Expansion of existing facilities and transportation networks will not always be the most effective approach. If new mines for export are developed in the West, it may make sense to develop a total system for mine to-terminal-to-ship transportation. If large volume, long-term export contracts are negotiated in the East, and harbors are not dredged, it may make sense to develop an offshore, deep-water, coal-loading terminal. The technologies to transport coal for export with dedicated systems outside of existing networks can be available without excessive development. While most of the efforts to develop new systems are in the private sector, certain Federal actions could help or hinder development—e.g., if some harbors are not dredged, alternative systems for offshore loading could be more attractive. However, one should consider these alternatives with caution because most are not short-term options, the technologies are not yet in place and foreign buyers, shippers, and terminals will need to agree and adapt to any major changes.

High-Capacity Terminals

To a large extent, high-capacity export terminals are being developed because of the increased demand for steam coal. The new terminals typically occupy 100 acres or more, and ideally up to *600* acres. This allows for the arrangement of a series of open-storage stacking areas, and the use of stacker/reclaimer mechanical equipment.

Almost all new proposals for developing high-capacity export terminals involve the use of stacker/reclaimers. Historically, coal export terminals were designed to service up to 200 different blends of high-grade metallurgical coal. Consequently, the coal is stored in railcars until blended and loaded. Steam coal does not require as much care in loading and ideally is ground-stored, allowing for the use of high-speed equipment.

Beyond these recognitions, the most concrete way of defining a high-capacity terminal is by way of the example offered by McDuffie Terminal in Mobile, Ala. Designed in the early *1970's,* McDuffie became operational in 1975,

and incorporated the newest and most innovative approaches available to material handling, automatic barge unloading, and unit train movement. A three-phase design concept was developed. Phase I is entirely developed. Phase II is more than 75-percent complete. Phase III will be finalized by 1983-84.

Coal arrives by both barge and railroad at the terminal. Barges are unloaded by a high-capacity ladder-type bucket elevator unloader capable of moving 1,500 tonne/ hr. The bucket elevator remains stationary while the barge is moved back and forth beneath it to allow the unloader to remove coal and place it on the conveyor system. From here the coal can be stored in large piles, known as open storage, or go directly to a waiting vessel.

The same conveyor system serves the rotary car dumper for unloading rail cars rapidly. Standard coupled cars are unloaded at a rate of 25 cars/hr. It is projected that swivel coupled cars in unit train lots can be unloaded at 30 cars/ hr.

Once the coal is unloaded from barges or railcars, it can be loaded directly onto a ship or put into stacking yards for later loading. The mechanism used to take the coal from the conveyor system, or return it to the conveyor system from the storage piles is known as a "stacker/reclaimer ," The stacker/reclaimer is an enormous piece of mechanical equipment capable of moving up to 4,000 tonne/hr of coal. It is equipped with one long outreach boom, usually measuring more than 150 ft, numerous internal conveyor systems, operator cabin, etc. The stacker-reclaimer is the heart of the new high-capacity coal-handling terminals. Two stacker/ reclaimers are currently located at McDuffie, and a third is scheduled for delivery once the third phase of development is underway.

Coal Slurry Systems

Thus far, no coal slurry system is in operation designed to move coal for export. The only operational line in the United States, the Black Mesa line serving Las Vegas, has been used successfully since *1970*. It carries more than 5.5 mmt/yr through some *270* miles of 18-inch pipe serving the Southern California Edison Co. Proponents of the slurry systems cite the Black Mesa line as proof that larger and more lengthy systems can be replicated. Opponents of the systems maintain that until a more substantial effort is constructed, the successful implementation of slurry pipelines must remain in question.

A number of companies specializing in pipeline technology have developed complete engineering design plans for exporting coal. Recently, a project manager with Wheelabrator-Frye described the mechanics and economies of an offshore export buoy. [a]

The coal slurry export terminal would operate something like the deepwater crude oil import systems, only in reverse. Proponents suggest slurry export terminals as a rapid means for short-circuiting the port bottleneck, claiming them to require no piers or deep-draft harbors, and to be environmentally acceptable.

The basic concept requires either a slurry pipeline from the mine or a slurry terminal several miles inland with adequate rail and/or barge connection. The terminal would be similar to any other open-storage coal stacking yard such as at Mobile, or Superior, Wis.

The coal would be ground into the slurry mixture and piped to an offshore, single point, mooring buoy, for loading vessels up to 200,000 dwt.

Two types of system movements are contemplated:

- slurry load—slurry unload, and
- slurry load — dry (conventional) unload.

The need to consider the dry unload capability is obvious. Without a slurry unload system on the receiving end, the coal would have to be unloaded using conventional techniques. One major obstacle in implementing the slurry export process is, in the event of a dry unload requirement, the coal must not be more than 12 percent liquid content. Thus, once the coal is delivered to the vessel in slurry form it must be

[a] American Association of Port Authorities, "Coal and Ports Symposium, " Feb. 16-19, 1981, Mobile, Ala.

dried to 12 percent to avoid damage to the dry unload equipment and procedures.

This problem has not been solved completely according to the official of Wheelabrator-Frye. However, if a slurry unload system were developed somewhere in Northern Europe, only 27 to 36 months would be needed for construction of the terminal in the United States. Favorable sites have been identified in Alabama and North Carolina.

Several major domestic coal slurry pipelines are under consideration. They are being designed primarily to serve domestic utility and manufacturing consumption. In addition, the slurry design engineers are quick to point out that little extra effort is required to extend the pipelines to offshore buoys.

Studies have been conducted of the use of coal slurry pipelines both to transport coal from the mines to the port and from the port to a collier anchored at an offshore terminal. While experience is being gained in the West for transporting coal by means of a slurry pipeline from a mine to a powerplant, it is not clear whether wide-scale use is practical over longer distances for long periods of time. Water requirements are a major factor. Saltwater cannot be used in coal slurry operations because of absorption of the salts into the coal. Consequently, nonsalty water must be used and recycled through the system, including shore-to-ship and ship-to-shore. In some locations, competing use for the available freshwater will hinder the development of slurry pipelines for coal export.

The issue of eminent domain continues to plague the slurry advocates. In order to transfer coal by slurry from interior points, the slurry lines must cross or run parallel to property owned by railroad companies, the slurry lines' major competitors. Thus far, the railroad lobby groups have been able to block attempts to grant permission to slurry interests to cross railroad property. Unless the right of eminent domain is granted, it is unlikely that interior slurry lines will be constructed. This is why the proposals for exporting coal by slurry rely on rail and/or barge for delivery to the slurry plant.

Midstream Transfer

Though not commonly utilized, several existing instances of direct barge-to-ship, or "midstream" transfer can be identified. At the Port of New Orleans, coal-handling stevedoring firms are providing midstream transfer by placing a grab-bucket crane-barge between an ocean-going vessel and a coal barge, and simply moving coal from barge to vessel.

An improved version of this concept is scheduled to be implemented in the Great Lakes this spring. Canadian steamship owners and operators have indicated that they intend to use self-unloading dry-bulk colliers to ship coal from the Great Lakes, through the St. Lawrence Seaway lock system, to the deep-draft port of Quebec City on the St. Lawrence River. The self-unloaders would then transfer coal to larger, ocean-going vessels for the international journey. The midstream transfer is less costly than double handling at a transshipping port site.

Port officials at New Orleans cite that very large tonnages could be loaded by midstream transfer techniques and several companies have stated they intend to pursue this approach.

There are very few technical and/or equipment limitations to this approach, and appears more and more to be a highly acceptable formula which can be immediately implemented. The one major obstacle to this approach is guaranteeing that a sufficient number of coal-carrying barges are in place to meet foreign steamship vessels when they arrive. But this should not present extreme difficulties. Of course, it would be necessary to provide a deep-draft sheltered area to load very large colliers.

Pneumatic Pipelines

Pneumatic transport is no a new concept. It has been used commercially for the movement of ores and other materials Basically, it is a pressurized pipeline into which coal is fed and conveyed in a suspended state by compressed air. There are a number of advantages to this mode. Among them are ease of automation, no need for water, and flexibility.

Air is used as the carrier and is thoroughly cleaned before vending. Unlike coal slurry lines, it is easily started after stopping, avoids the expense and disposal problems of dewatering, avoids the cost expenditure of crushing coal to a fine powder, and does not present the same problems as slurry lines in the event of line breaks.

The most immediate application appears to be as an adjunct to rail or barge transport. In this role a pneumatic pipeline may operate as a loader/unloader and gathering/feeder systems. It could possibly compete with short-haul unit trains, conveyor belts, and truck transport.

Pneumatic pipelines have not been used for coal transport and the most recent uses have been for much different products over short distances. This system will require testing before a determination of economic or technical feasibility.

Conveyor Belts

Conveyor belts are an old, established method for the movement of bulk materials. Most applications are short-distance oriented such as may be seen at coal mines or handling terminals. Yet, long-haul movements of coal in enclosed conveyor belt systems are entirely feasible.

Conveyor systems, like slurry lines and pneumatic lines, are capital-intensive, requiring little staffing with respect to distance. Costs decrease with both distance and throughput. However, previous research has indicated that system economics are best where throughput is neither variable nor intermittent.

As an operation, belts are relatively noisy and can create spillage and dusting problems. Belt width can minimize spillage, and a covered system reduces both noise and dust.

For practical purposes, the system should be above ground. But this creates land-use and right-of-way problems. Also, ambient temperatures affect the operation and may limit usefulness in areas of extreme cold or heat.

Once in place, the conveyor belt is not very flexible. Like pipeline operations, failure at any point can jeopardize the entire system.

Extra Wide-Beam Ships

A design for ships of wider beam hull forms has been considered for coal carriers for restricted draft service. For draft restrictions characteristic of U.S. ports, about 30 to 50 percent increase in deadweight tonnage can be obtained by accepting reasonable departures from conventional ship proportions. Transport costs are significantly reduced by using ships of greater capacity. However, the construction costs for wider, shallow-draft ships would be higher than for conventional ships for a given tonnage. A modification to loading facilities may also be required to accommodate the increased beam of the shallow-draft collier,

Navigation in shallow water will be different for the wide-beam ship, manueverability characteristics in restricted waters will probably be significantly different and may require more channel width than normal ships. However, if found suitable for bulk cargo transport from restricted channel depths of U.S. ports, these ships may provide important side benefits. They, as a class, could be useful for noncoal bulk cargo shipments from many ports. They have not thus far been mass produced in foreign shipyards; and *if* constructed using advanced technology, U.S. shipyards could possibly build them competitively for the international trade.

Barge Carrying Ships

Barge carrying ships also present an alternative to deepening shipping channels and may be particularly pertinent to coal users who are located on the inland water routes of Europe. The concept is an extention of present barge carrying ships used in the general cargo trade. Coal barges would be towed a deep part of the harbor for loading aboard oversized ships,

In one design, the barge size visualized for these systems is the standard 1,500-tonne Mississippi barge—195 ft long, 35 ft wide, and 12 ft

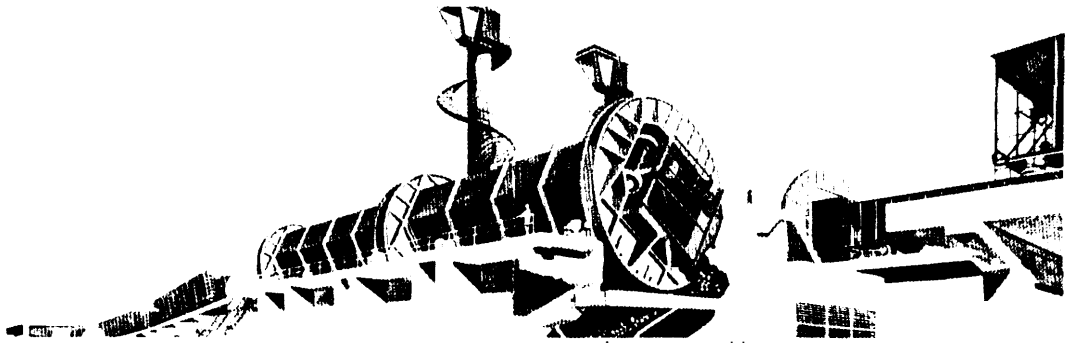
deep with a draft of 9 ft. Up to 80 of these would be loaded onto five decks of the carrier ship which is estimated to be approximately 1,257 ft in length, 213 ft in beam, and *38.7* ft in draft.

The barges would be offloaded at the ship's destination and then towed to a location nearest the coal user plant. While an outer part of the United States and destination ports would have to be dredged deep enough to accommodate the barge loading and unloading operations, dredging might be minimized.

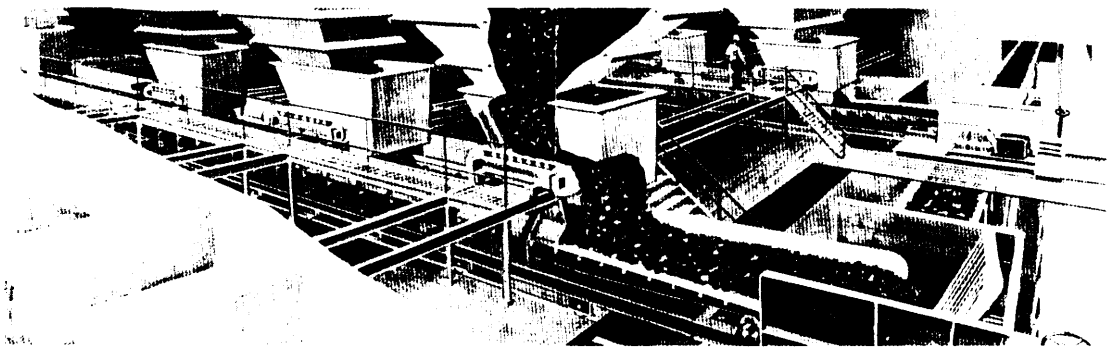
There are inefficiencies associated with this concept that must be considered in practice. There are nonpayload void spaces between barges and between decks. In addition, the added weight of the barge structure must be transported, and demurrage costs of at least one extra set of barges per ship would be involved.

However, the system could be used for other bulk cargoes and U.S. shipyards might participate in both ship and barge construction.

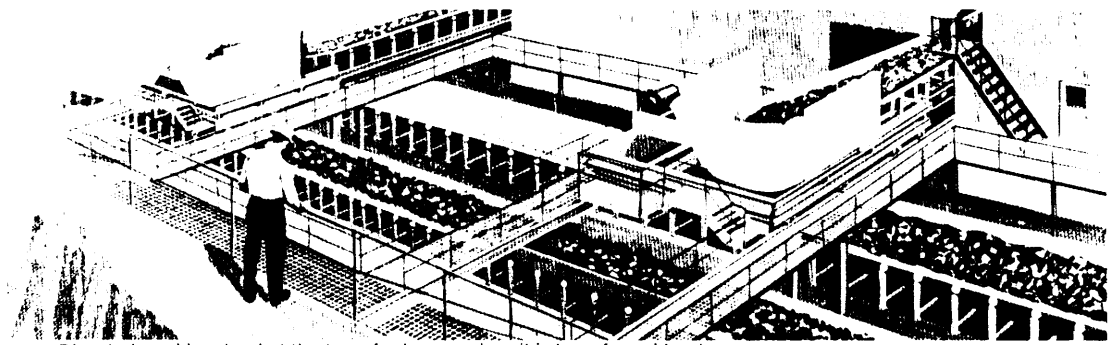
Schematic of the Norfolk& Western System, Norfolk, Va.



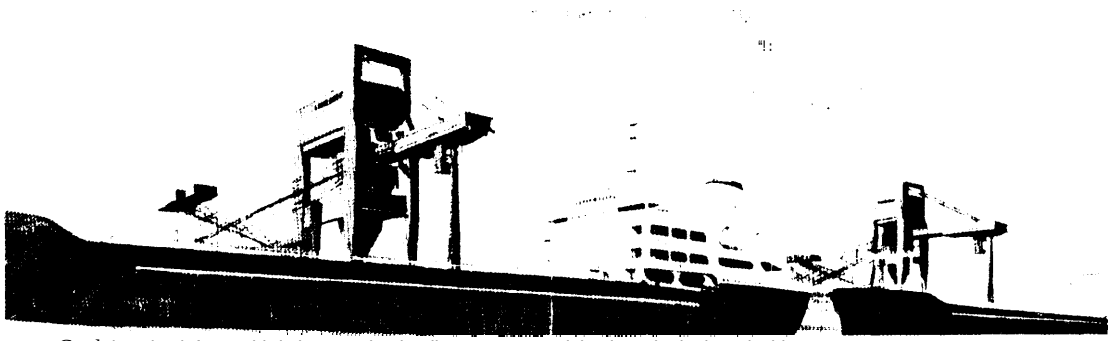
Rotary dumpers at Custom Blending Station empty four coal cars into transfer bins.



Coal, regulated by feeder mechanism, is placed on variable-speed shuttle conveyors.



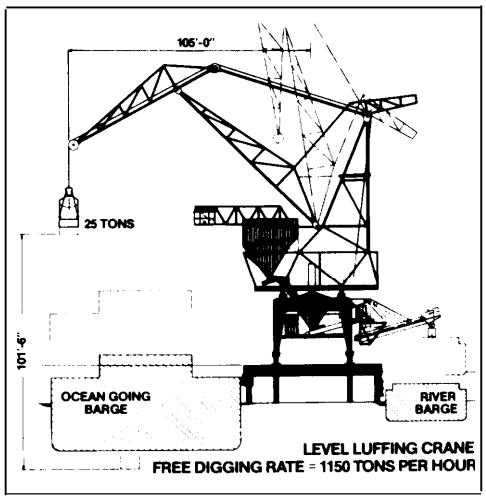
Blended coal is mixed at the transfer house when it is transferred to pier conveyors.



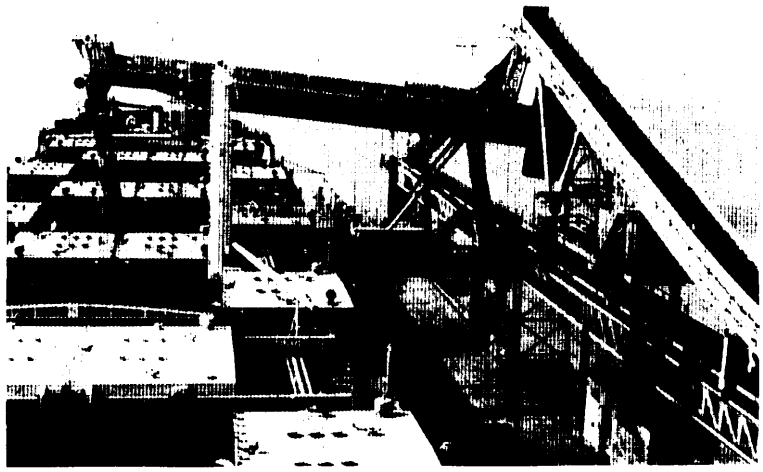
Coal is mixed for a third time at the loading towers, and is deposited aboard ship.

SOURCE Norfolk & Western Railway

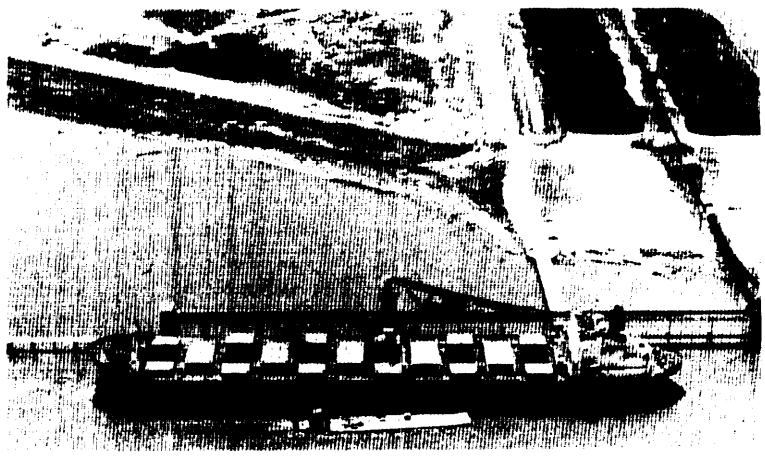
Mobile, Ala.



Schematic of level luffing crane



7,000 tonne/hr t raveling ship loader



75,000 dwt bulk carrier

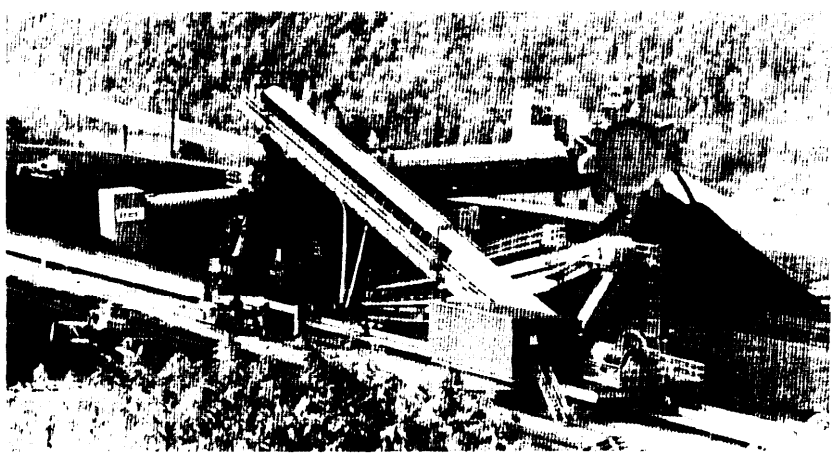


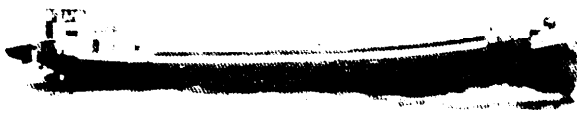
Photo Credits" Dravo Corp.

High capacity stacker/eclaimer system

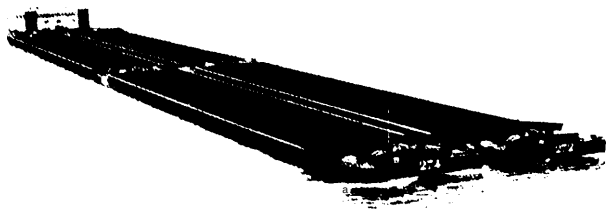
Rotterdam, Netherlands



Aerial view of Ekom Terminal, Rotterdam, Netherlands



Typical Rhine River self-propelled barge



Four-barge unit push tow

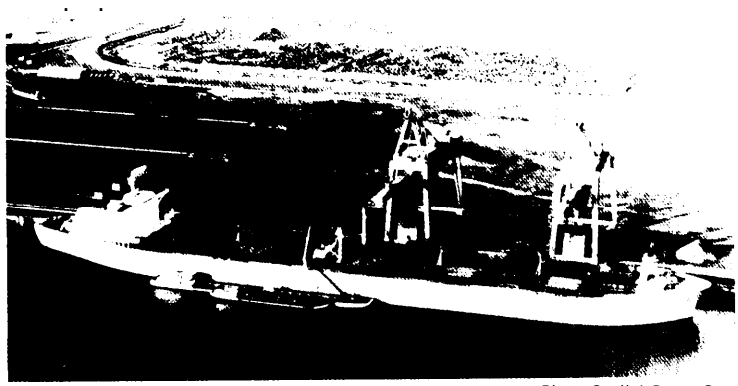
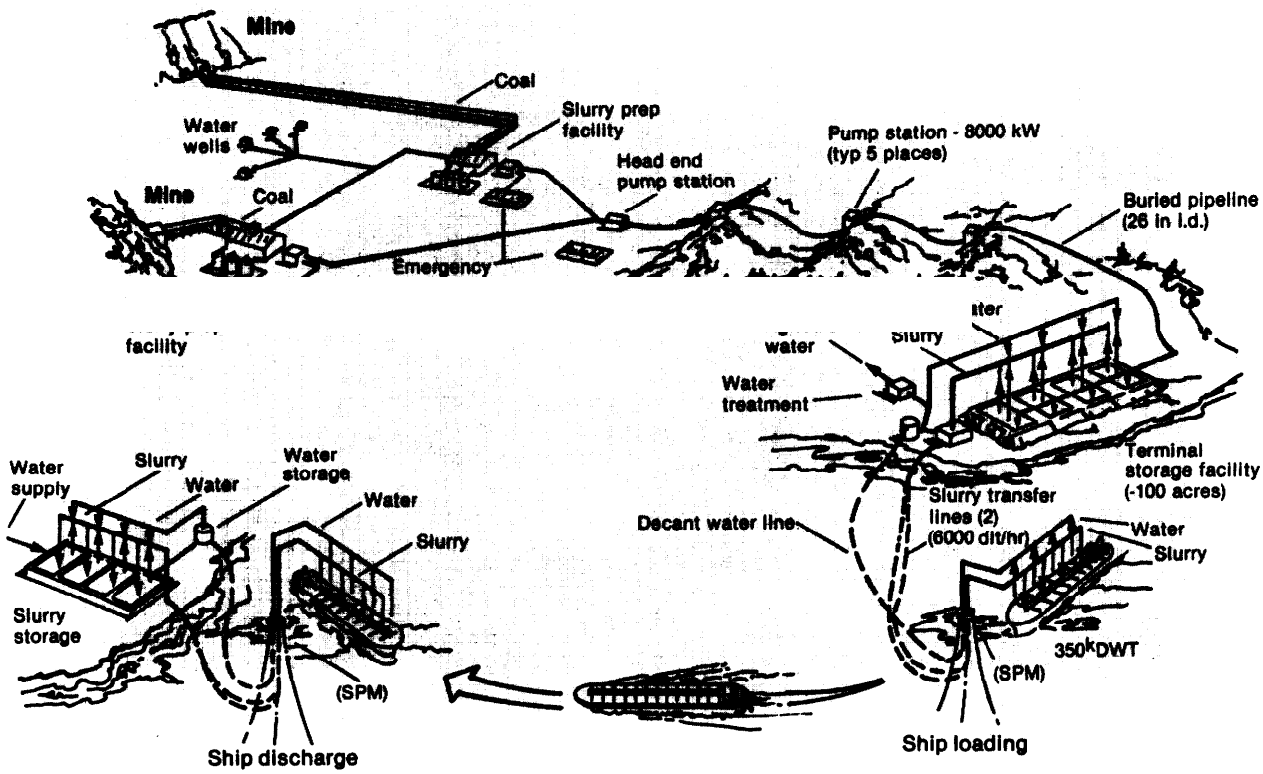


Photo Cred/ts' Dravo Corp

Unloading terminal for super-colliers at Rotterdam

Proposed Coal Slurry System From Utah to Oxnard, Calif.



SOURCE Boeing Co

Appendixes

APPENDIX A

Status of Harbor Dredging Projects

Costs and Benefits of Dredging

Cost-benefit analyses are used by the Corps of Engineers to assess the value of channel deepening projects. Most studies consider the type of vessel traffic to use the port, the drafts of vessels, forecasts of commodity flows, and other variables to compare benefits with costs.

The cost side of the analysis involves determining the costs necessary to establish and operate the project, interest charges, amortization of investments during the specified period, salvage value, and similar factors. The estimated economic cost is expressed in equivalent average annual terms to permit direct comparison with estimated benefits. It is the Corps' policy to assume a useful life of **50** years for port improvements.

After the monetary cost estimates are computed, then the benefits of the projects are measured. This is done by first determining the physical output of the projects. The objective of such measurement is to determine increases, net of associated or indirect cost, in the value of goods and services which result from conditions with the project as compared with conditions without the project. The value of the outputs is either the market value (demand price) or, in the absence thereof, the expected costs of production by the most likely alternative sources that would be utilized in the absence of the project.

The ratio benefit to cost is used as an indicator of the project's worth. Tangible benefits, as they are expected to occur, then are brought back to present worth by a given interest rate and then amortized to obtain average annual benefits. The ratio derived from dividing the average annual benefits by average annual costs is referred to as the "benefit-cost" ratio. Projects are seldom authorized unless the benefit-cost ratio exceeds one.

Federal Funding of Dredging

Although estimates are available for approximating the cost of dredging a certain number of cubic yards of material from a harbor bottom, a wide range of variables can impact the cost. Some of these are:

- cost of local labor;
- geological composition of material;
- distance the material needs to be transported for disposal; and
- cost of disposal area (ocean dumping, port development fill project, creating new disposal area).

Research conducted by the Corps of Engineers, Water Resources Center indicates that between 1963 and 1979, annual expenditures for improvement dredging actually decreased 22 percent from $107 million to $83 million. Moreover, the unit costs for improvement dredging were $0.41/cubic yard ($yd^3$) in 1963 and increased to $1.73/$yd^3$ in **1979.** Maintenance dredging over the same period saw unit prices increase from $0.27/$yd^3$ to $1.03/$yd^3$. Total annual expenditures in this area increased by a factor of four from **$59** million to $241 million. Figures prepared by the Corps of Engineers indicates that 289 million yds were dredged in the United States in 1980, and an estimated 320 million will be made in **1981 (see** table A-1). Of the 1981 totals, the Corps would be expected to handle 95 million, and private industry contracts with the Corps for the remaining 225 million for 1981. On the cost side, the Corps itself is expected to directly assume $115 million and Corps contracts to private industry $337 million in 1981 (see table A-2).

The numbers presented in tables A-1 and A-2 must be viewed in the context of estimates for new channel deepening projects. Assuming a reasonably high $2.00/$yd^3$ dredging costs, and a 200-million-yd^3 project, a total bill of $400 million results. This level of dredging for new construction is a reasonable estimate for a major new project at one port.

Channel Improvement Process

There are both private and Federal public sector efforts involved in channel maintenance, improvement, and new dredging activities. Non-Federal efforts, both private and local governmental, are primarily directed to dredging of channels to and around private docks from main channels. There have also been limited non-Federal efforts in the dredging of short main channels. However, these cases are rare and more often than not pertain either to artificial ports or for channels that are used primarily by a single industry. The Federal efforts are conducted by the Corps of Engineers.

Table A-I.—Corps of Engineers Cubic Yard Dredging (millions)

	With Corps equipment			With private industry equipment		
	Maintenance	New work	Total	Maintenance	Newwork	Total
1978	92	2	94	118	68	186
1979	87	3	90	147	45	192
1980	81	1	82	154	53	207
1981 (est.)	95	0	95	153	72	225

SOURCE: Corps of Engineers.

Table A-2.—Corps of Engineers for Dredging ($ millions)

	With Corps equipment			With private industry equipment		
	Maintenance	New work	Total	Maintenance	New work	Total
1978	90	2	92	124	91	215
1979	87	8	95	154	75	229
1980	92	3	95	193	95	228
1981 (est)	115	0	115	184	153	337

SOURCE' Corps of Engineers

The two dredging activities—the non-Federal dredging and the Federal dredging—necessarily go through two different Federal Government administrative processes. The non-Federal Government dredging requires a permit from the Corps of Engineers. The Federal dredging requires the Congress to enact legislation to request the Corps to conduct a feasibility study followed by an act to provide authorization for construction and then by appropriations acts to provide funding. During the Corps study environmental considerations and other public concerns are taken into account and public hearings are held similar to those required for non- Federal efforts.

Permit Process for Non-Federal Dredging

A Corps of Engineers permit is required whenever a project is considered which would affect the waters of the United States by:

- locating a new structure;
- excavating, or discharging dredge or fill material; or
- involve transporting dredged material for the purpose of dumping it into ocean waters.[1]

However, not every activity requires a separate permit application. Certain activities and work have been authorized by nationwide permits and general permits.[2]

[1] See Corps of Engineers, ***Permit Program A Guide for Applicants,*** EP 1145-2-1, Nov. 1, 1977).

[2] nationwide permit is a form of general permit which authorizes a category of activities throughout the Nation. Nationwide permits are designed to allow work to occur with little, if any, delay or paperwork.

Prior to actually submitting an application to obtain a permit, applicants are encouraged to contact the District Engineers Office having jurisdiction over specific geographic location of the structure or activity.

Each application is evaluated to determine the probable impact the structure or activity will have on public interest. This is where many delays can occur. The Corps is responsible for coordinating the responses to the project of numerous State and local governmental bodies and civic groups. If any one organization objects to the project, then additional consideration must be given to overcoming the difficulties the objecting organization sees. In some cases, an environmental impact statement (EIS) may be required and simply developing the background data for the EIS can take 2 years or more. In other cases, less stringent environmental impact assessments or environmental reviews maybe needed.

Once all data have been submitted, the District Engineer will issue a public notice seeking comments on the proposed action. A normal 30-day comment period is given to responding agencies, but this period is usually exceeded, contributing to additional delays. A public hearing may then be held if the District Engineers believe there to be sufficient reason to allow an additional forum for public comment. Once all public comment is obtained, the District Engineer takes all information and based on a series of evaluation factors will make a final decision to approve or disapprove the application. In the event that a permit is denied, a complete procedure is available for appeal.

Recently, the Corps released a proposal for the purpose of speeding up the review process needed to obtain Federal permits.[3] There are several specific procedures recommended for shortening the leadtime required, but, in short, the proposed regulations are designed to impose time limits on the accomplishment of goals, and require reviews of contested applications to be "pulled" from high levels of decisionmaking, rather than "pushed" from lower levels. This forces decisions to be made by the lowest possible level, where most attention to detail can be devoted and decisions can be more timely. In the event that the Corps does not grant a permit, or a granted permit is contested by a local public agency or civic organization, a ranking official representing the contesting group must request that the application be reconsidered at the next highest level. Such a procedure is designed to limit permit reviews at the highest levels of the Corps of Engineers.

Also, memoranda of agreement were established between the Corps and five involved Federal agencies requiring that to the maximum extent practicable, a decision should be made on individual applications within 90 days of the issuance of the pubic notice.

Federal Process for Port and Channel Improvement Projects

The Corps of Engineers has a rather strict set of procedures through which it must operate in the process of developing channels and other public works. There are four basic controls which Congress has on the selection and timely development of the public works. First, Congress must request the Corps of Engineers to conduct a feasibility study of the improvement which local groups perceive to have merit. Such a feasibility study includes engineering considerations, cost factors, environmental concerns, and perceived benefits. After the completed feasibility study is forwarded to Congress, further studies or engineering of that particular improvement are undertaken as project funds are "extinguished" on the submittal of the feasibility report to Congress. The next action that Congress takes is to authorize the, project; however, further work by the Corps must await congressional appropriations actions. However, the appropriations are generally only yearly. Thus, each year Congress must reconsider the individual project as it progresses and appropriate funds for the next year.

[3] *Federal Register* part VI, Department of Defense, Crops of Engineers, Department of the Army, "Proposal to Amend Permit Regulations for Controlling Certain Activities in Waters of the United States, " Sept. 19, 1980, p. 62732.

Besides Congress and the Corps of Engineers, other agencies, the State governments, and the interested public become involved in the review process of public works projects. These often become quite controversial when environmental issues become of great concern and do cause delays and modifications in the program. In dredging, the site selected for depositing the dredged materials often becomes particularly controversial.

The 19 steps of establishing and constructing new projects is given in table A-3. Maintenance dredging, a 20th step is not listed, but does occur and requires annual funding for larger projects and occasional, but predicable funding for smaller projects.

Status of Present and Proposed Coal Port Projects

There have been many proposals to improve various ports to increase export capabilities. Some of these are just conceptual, others are in some stage of the Corps of Engineers 19 steps, previously discussed. The four predominant coal ports, have major improvement projects in planning or design. Table A-4 lists the proposed improvements to these ports. The status of the projects, as of April 1, 1981, to improve these four channels is as follows:

Baltimore.—Feasibility complete, approved by the Corps of Engineers and Secretary of the Army and deepening of the channels authorized by Congress. *Step 26 is underway:* The Secretary of the Army is entering into formal agreements with non-Federal interests to fulfill their obligations. Appropriations action would have to follow for the actual construction to be initiated.

Hampton Roads.—The District report has been reviewed by the Board of Harbors and Rivers and has issued its recommendations. *Step 10 is underway:* The Chief of Engineers is coordinating the report and the EIS with the Governor of the affected States and with the Federal Department heads. After this step, the Secretary of the Army will review the report and submit it and the EIS to Congress for authorization.

Mobile—The feasibility report has been completed by the District. *Step 9 is underway:* The Board of Rivers and Harbors is reviewing the report.

New Orleans—A reconnaissance phase has been completed and the results found favorable. Preliminary alternatives have been selected by the Corps District Office and public involvement initiated. *Step 6 is underway:* The preparation and circulation of the preliminary draft report and the preliminary EIS.

Table A-3.—How Corps Projects Are Conceived, Authorized, Funded, and Implemented (preauthorization)

1. Public requests assistance from congressional delegation to solve water resources problems
2. Committee on Public Works of House or Senate authorizes study
3. Initial funds for study enacted into law
4. Corps district conducts reconnaissance (Stage 1 Planning)—includes public meeting and other forms of public involvement
5. If results of reconnaissance favorable, Corps district continues study and develops preliminary alternatives (Stage 2 Planning) –includes public meeting and other public involvement
6. Corps district selects several alternatives to develop in detail and on the basis of further evaluation tentatively selects plan, which best achieves the objectives of the study (Stage 3 Planning) —includes public meeting and the preparation and circulation of draft report and draft environmental impact statement (EIS)
7. District engineer submits report and EIS to division engineer
8. Division engineer submits report and results of division review to Board of Engineers for Rivers and Harbors fBERH)—includes includes public notice
9. **BERH 'reviews district and division recommendations and issues its findings and recommendations—in**cludes public notice of recommendations
10. Chief of Engineers coordinates proposed report and EIS with Governors of affected States and Federal department heads
11. Chief of Engineers report reviewed by Secretary of the Army and the Office of Management and Budget and submitted to Congress—final EIS filed with EPA
12. Committees on Public Works hold hearings and include project in authorization bill or authorize by joint resolutions
13. Initial funds for Advance Engineering and Design (AE&D) for project enacted into law–usually several years after authorization
14. Corps reaffirms plan based on current conditions and any new planning criteria applicable to project—includes a public meeting and other forms of public involvement
15. If plan reaffirmed, or satisfactorily modified to accommodate new conditions or criteria, Corps continues with sufficient engineering and design to award initial construction contracts
16. Non-Federal interests required to enter into formal agreement with Secretary of the Army to fulfill their obligations, as authorized by Congress
17. Initial funds for construction of project enacted into law—requires specific decision by President and Congress to initiate construction of project
18. Continuation of engineering and design and project construction—may include adjustments based on results of detailed engineering design
19. Completion of project construction

SOURCE: Corps of Engineers

A summary listing of project status of the major coal exporting ports and other coal exporting, or potential coal ports, is as follows:

Project port	*Present* project *step underway*
Principal coal ports	
Baltimore	16
Hampton Roads	10
Mobile	9
New Orleans	6
Additional coal ports (or potential)	
East coast:	
New York City	2
Charleston, S.C.	10
Savannah, Ga.	7
Brunswick, Ga.	10 (unfavorable)
Gulf coast:	
Galveston, Tex.	
(Texas City)	6
(Pelican Island)	Permit granted to private organization.
Sabine, Tex.	6
Corpus Christi, Tex.	6
West coast:	
Columbia River, Wash, (Astoria)	6
Kalamia, Wash.	Permit requested for private dredging
Bellingham, Wash.	Deepening not required, step not applicable
Gray Harbor, Wash.	6
Long Beach/Los Angeles.	18
Sacramento, Calif.	9

Acceleration of Corps Process

There have been numerous suggestions for fast tracking the Corps 19-step process, Most of these involve the accelerating or avoiding of three delays. These are: 1) delays caused by serially conducted reviews within the Corps of Engineers as well as by other agencies and outside interested States and organizations; 2) delays in design and engineering due to lack of funding while project authorization and appropriation bills on favorable projects are acted upon in Congress; and 3) delays caused by yearly resubmission of project funding request and appropriation thereof by Congress.

The Corps is in the process of implementing the concurrent reviews of key projects. The Corps schedule under their revised report system for Norfolk, Mobile, and New Orleans is shown on table A-s. Concurrent review outside the Corps, over which it

Table A-4.—Proposed Improvements to Existing Coal Harbor Channels

	Channel depth (ft)		Vessel size capacity (dwt)		Capital cost (10 $)	Annual operating and maintenance costs (lo $)	
	Current	Proposed	Current	Proposed		Existing	Increased
Hampton Roads[a]	45	55	80,000	100,000 +	372 (April 1980)	6.2	2.5
Baltimore	42	50	70,000	100,000 +	278 (October 1980)	4.0	0.8
Philadelphia	40	—	60,000	—	—	8.2	–
Mobile[a]	40	55	60,000	100,000 +	392 (August 1980)	8.7	2.4
New Orleans[b]	40	55	60,000	100,000+	440 (May 1980)	19.5	75.0

aFeasibility studies completed and report now under review at levels of the Chief of Engineers and the Secretary of the Army
bFeasibility study in final stages of completion by the District Engineer.

SOURCE: Corps of Engineers.

has no control, has not been initiated. This will require action by the other Federal Agencies involved in the review and approval process.

To avoid the delays in design and engineering incurred while awaiting authorization and appropriation by Congress, the Corps in its fiscal year 1982 budget has submitted a request for funds and authorization to conduct continuing studies for those projects found favorable. The budget submitted to the Office of Management and Budget requested $2 million for continuing studies in fiscal year 1982, which was reduced to $1 million before submission to Congress.

te avoid the hiatus that occurs between fiscal years, it has been suggested that two possible congressional alternatives exist: 1) appropriate funding for the full project, or 2) provide multiple-year funding.

Table A-5.—Coal Ports Reports Schedule (for planning)

Milestone	Norfolk (Hampton Roads)				Mobile Harbor				New Orleans (M R-GO)			
	Best estimate	Maximum acceleration[a]	Presidental initiative	Incremental contruction	Best estimate	Maximum acceleration[a]	Presidental initiative	Incremental construction	Best estimate	Maximum acceleration[a]	Presidental initiative	Incremental contruction
Report forwarded to BERH	Aug 80	same	same	same	Nov 80	same	same	same	Jun 81	same	same	same
Chief of Engineers' proposed report (and FEIS) to ASA(CW), OMB, and to States and agencies for review	Mar 81	same	same	same	Apr 81	same	same	same	Oct 81	same	same	same
Statutory review periods end	Jun 81	same	same	same	Jul 81	same	same	same	Jan 82	same	Nov 81	Nov 81
Chief's final report to ASA(CW)	Aug 81	Jul 81	Jul 81	**Jul 81**	Sept 81	Aug 81	**Aug 81**	Aug 81	Mar 82	Feb 82	Dec 81	Dec 81
Report to WRC	Aug 81	Jul 81	**N A**[b]	**N A**[b]	Sept 81	Aug 81	**N A**[b]	**N A**[b]	Mar 82	Feb 82	NA	NA
Report to Congress[c]	**Nov 81**	Oct 81	Aug 81	Aug 81	Dec 81	**Nov 81**	Sept 81	Sept 81	Jun 82	May 82	Jan 82	Jan 82
Congress authorizes	**1981**	1981	1981	Sept 81[d]	1982[e]	1981	1981	Oct 81[d]	1982	1982	1982	Feb 82[d]
AE&D complete[f]	**1984**	1984	1984	Mar 82[g]	1985	1984	1984	1982[h]	1985	1985	1985	Jul 83

aAssumes ASA/CW will expedite to extent possible. Potential expediting within the President's purview (items 3 and 5) were not assumed,

bInvolves directives to agencies to accelerate 90 review to 30 days, and to waive independent project review.

CAssumes 2 months to process report through WRC and 1 month to process through OMB. We estimate that this is the fastest possible progress for Complex projects and assumes we have taken all "assurance" steps to maintain progress.

dAssumes Congress authorizes within 1 month of receipt.

eDepending on congressional session dates in relation to report submissions, a 1981 authorization could be possible.

fAssumes efforts to compress from the expected 4 t. 5 years required are successful assumes concurrent funding of AE&D and authorization; and assumes a 3 year AE&D effort (18 to 24 months for Phase I and 12 to 18 months for P&S) AE&D is considered complete when plans and specifications for the first major contract are approved

gconstruction begins for 50-ft stage. No environmental Issues or factors have been raised concerning this stage.

hMobile cannot accelerate unless disposal issue is resolved: disposal is controversial, First increment is widening and turning basin.

'One preliminary plan involves an initial construction phase of 55ft from the Gulf to River Mile 60 above Head of Passes.

SOURCE: Corps of Engineers, Mar. 16, 1981

Appendix B

Legislation Relevant to Coal Port Development Introduced in the 97th Congress Through April 1, 1981

House

HR-55 —Ports and Navigation Improvement Act of 1981
Sponsor: Boggs, 1/5/81
Specifies selected ports for dredging
Expedites process for project implementation

FIR-2249 —Ports and Navigation Improvement Act of 1981
Sponsor: Breaux, 3/3/81
Identical to HR-55

Senate

s-68 –Ports Improvement Act of 1981
Sponsor: Randolph, 1/6/81
Specifies ports for dredging
Requires expedited procedure for Corps

S-202 —Ports and Navigation Improvement Act of 1981
Sponsor: Hollings, 1/22/81
Specifies expedited process for harbor dredging projects, esp. Charleston, S.C.

S-576 —National Harbor Improvement Act of 1981
Sponsor: Moynihan, 2/26/81
Establishes a task force and national planning process
Specifies a schedule for projects
Specifies a cost-sharing procedure

S-621 —National Water Resources Policy and Development Act of 1981
Sponsor: Domenici, 3/5/81
Establishes a planning procedure and schedule with Water Resources Council as coordinating body
Specifies cost-sharing procedures

S-809 —Recovery of Certain Costs Associated with Construction of Deep-Draft Channels and Certain Ports (Administration request)
Sponsor: Stafford, 3/26/81
Specifies cost sharing through user fees

S-828 —Ports and Navigation Improvement Act of 1981
Sponsor: Johnston, 3/30/81
Expedites harbor-dredging projects for selected coal ports

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