

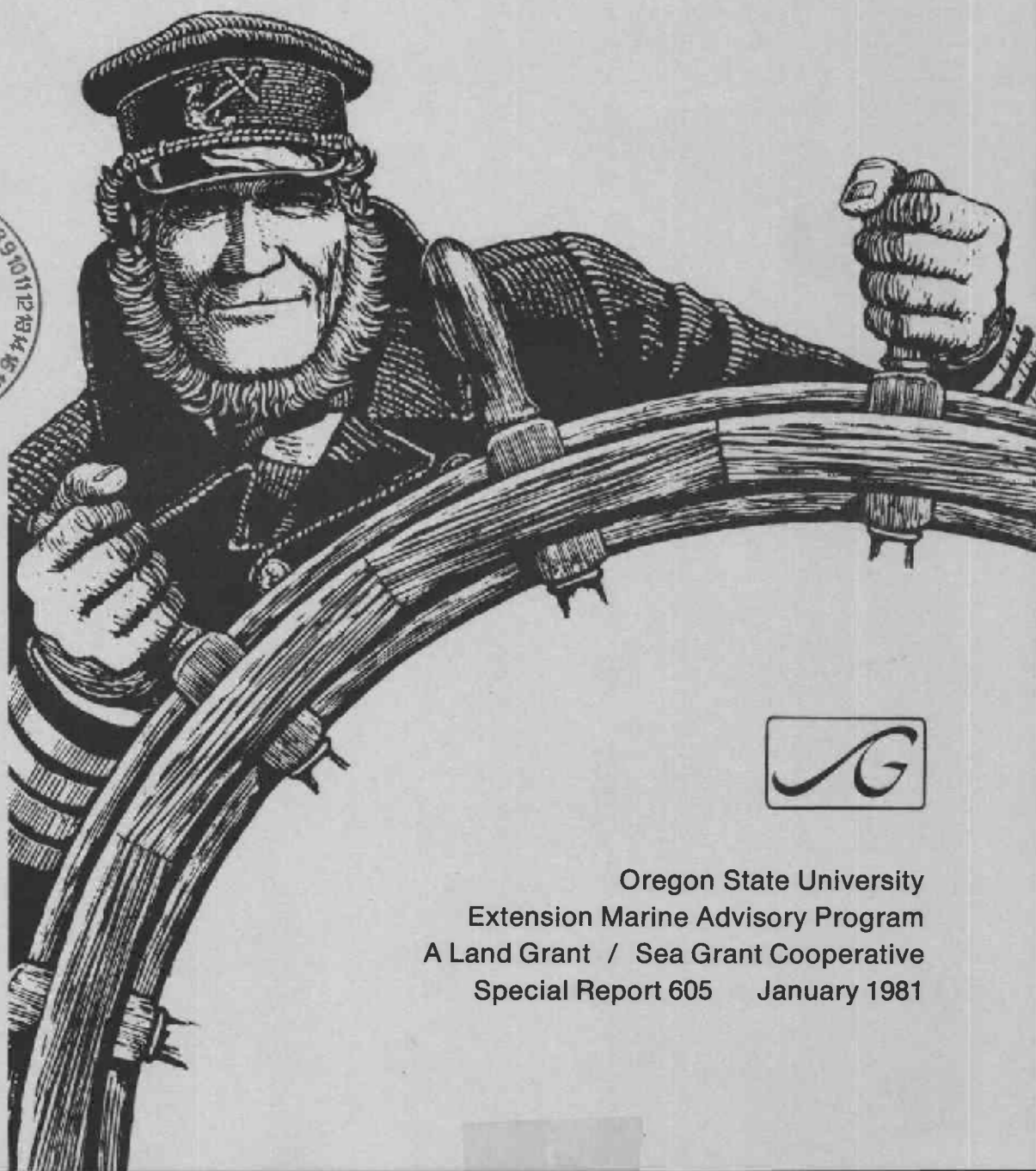
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# Where Will Maritime Industries Be in the Year 2000?

*The Future of Northwest Maritime Industries VII*

*Proceedings of the Conference*

*Red Lion at Lloyd Center, Portland, Oregon / 16 September 1980*



Oregon State University  
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# Where Will Maritime Industries Be in the Year 2000?

## *The Future of Northwest Maritime Industries VII*

A Conference Sponsored by  
Oregon State University Extension Service  
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Propeller Club  
Women's Shipping Club  
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Portland Steamship Operators

Portland, Oregon  
16 September 1980

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## INTRODUCTION

*Gib Carter*

Marine Agent, Oregon State University Extension Service,  
Multnomah County Office, Portland



This summary of the Seventh Annual Conference, *The Future of Northwest Maritime Industries*, is forwarded for your information. Copies have been sent to each registered participant and other interested agencies and individuals.

The attendance at this conference was the largest yet and likely the optimum size for the scope and nature of this conference. I am convinced that the original objectives of this conference, improved communications within the industry and achievement of a better informed and productive maritime community, are still valid. The periodic exploration of issues, challenges, and opportunities on the Columbia River by regulatory agencies, the academic community, and the commercial maritime industry provides a worthwhile exercise for each participant.

The temptation is great to look outside the Columbia River scene and study the whole Pacific Northwest at some future conference. I believe our interests are best served by confining the conference subjects to those Washington and Oregon issues related to the Columbia River transportation and other maritime concerns.

This conference was my first involvement with many of you, and it was a most rewarding and pleasant experience. I am indebted to the generosity of the steering committee, the willing and capable speakers, and you, the active participants, for the success of the seventh conference. The Oregon State University Extension Marine Advisory Program--the Portland office in particular--is most appreciative of assistance received in support of this conference.

In particular, I extend a special thank you to Chuck Miller, Port of Vancouver, and Steve Lindstrom of Pacific N.W. Waterways Association. Chuck gave a moving remembrance of Ed Condon, the OSU Extension oceanographer who was the originator and driving force behind these conferences for so many years. And Steve Lindstrom provided an excellent summary of the conference at the end of the day.

You are invited to comment on the past meeting and offer suggestions for discussion at the next conference scheduled for 15 September 1981 in Portland, Oregon.

I look forward to seeing you at the Eighth Annual Conference of *The Future of Northwest Maritime Industries*.

SUMMARY OF UNEXPECTED MARITIME CHALLENGE: MOUNT ST. HELENS

*George Nakata*

General Manager, Marketing, Port of Portland



After 123 years of inactivity, Mount St. Helens erupted in May 1980. The resulting ash fall, mud slides, and stream blockage presented numerous problems to public agencies and brought an influx of national news media representatives.

In spite of the initial blockage of the Columbia River, a navigable channel was excavated within five days. The navigation channel is expected to be back to normal by Thanksgiving. The Port of Portland helped develop an "anti-baloney" kit to reassure the public that the Columbia River was healthy and that Portland was not knee-deep in ash.

The future of the maritime industry is predictably unpredictable. The Port of Portland has been the fastest growing port in the United States. It is expected that dry bulk tonnage--probably grain and coal--will double or triple by the year 2000. An estimated 11 additional berths will be needed.

The Columbia-Snake river system will continue to make economic advances. Barge traffic is the major contributor to upriver growth. The region should continue to increase its lumber and grain production and may develop new commodities, such as steel, bentonite, and cattle hides. At the moment, the maritime industry on the Columbia River and at the Port of Portland is prospering. Wheat tonnage is up from 1979, and China has had five vessels in port so far in 1980, taking on 350,000 tons of wheat.

PANEL: COLUMBIA RIVER NAVIGATION THRESHOLDS, CONSTRAINTS, AND OPPORTUNITIES

INTRODUCTORY REMARKS

*Commander Jack Patterson, U.S.C.G.*

Alternate Captain of the Port, Portland, Moderator



The Columbia River is one of the world's great highways of commerce. Two distinct types of trade take place on the river: deep draft vessels navigate between Portland-Vancouver and the sea, and river traffic moves much of the ocean cargo to and from the inland areas.

As cargo tonnage has increased, the number of transits through the river has not increased. Rather, vessels are getting larger and carrying more cargo.

The future of commerce on the Columbia River looks bright. With petroleum prices increasing and the need for electrical energy in the Far East rising, the Asiatic countries are looking for a new source of fuel. That source will undoubtedly be coal. The United States has the potential to become a major exporter of this coal to the Far East.

The regulation of trucking and the deterioration of our railroads will undoubtedly bring grain from new markets in the interior to the Columbia River.

China is a new and underdeveloped market that will bring increased commerce to the Pacific Rim ports. It will reach a level of about \$4 billion this year, a 75% jump from 1979. Portland will undoubtedly share a proportionate amount of the cargo to and from China.

As for commerce on the upper Columbia River, constraints on the movement of cargo between upriver areas are quite obviously the locks and the number of barges available. Another factor relating solely to grain is the inadequate availability of grain storage in the downriver areas.

Beyond all of this is another constraint, the competition from Puget Sound ports and San Francisco. Their development undoubtedly influences the cargo patterns on the West Coast and the Columbia River.

## Navigational Constraints at the Columbia River Bar

*Captain Martin West*, Bar Pilot  
Columbia River Bar Pilots Association



Navigational constraints have been discussed a lot lately. The conversation usually starts with the question, "What is the maximum draft we can promise customers for passage over the Columbia River bar?"

The answer is still 38 feet for a high water passage--and even then, some delay is possible if the swell is too high. I wish there were some justification for trying greater drafts because it would certainly do great things for some of the recent proposals for new coal and grain movements. However, the restraining factor for bar pilots on the Columbia River is the knowledge that the whole industry depends on them for safe passage. Business of many kinds would be jeopardized without that assurance.

Pilots have never known exactly how much water was under the ends of the ship, or under the sides when the ship pitches and rolls on the bar. They keep informed regarding the depths available on the bar and know the draft of the ships, but they have no way to predict how much the ship will pitch or roll.

Everything a pilot does is the result of judgment based upon past experience. More than half the time, all he is able to do is react to the "feel" of the ship and the bar condition because more than half of his work is done at night. Pilots have set maximum drafts in the past on the basis of what they can see and feel. This is not very scientific.

A few years ago, Congress authorized the Corps of Engineers to conduct a feasibility study for deepening the Columbia River bar. The bar pilots learned that some of the assumptions the Corps used to design channels were at variance with their experience. They became aware that the pitch, roll, yaw, heave, and sway motions of a ship had never actually been measured. Moreover, no information on actual wave characteristics at the bar was available.

Increased funding went toward monitoring vessel motions on the bar. Fifty-three random vessel crossings of the bar were monitored during the winters of 1978-79 and 1979-80. Most of these vessels and drafts of 30 to 35 feet and were 600 or more feet long. The information recorded in the monitoring operation was used to determine the total draft of the ship at the ends and sides during all its motions. By comparing the monitoring information with the total depth available, the bottom clearance was determined.

The results showed that the channel is being fully utilized and there is not room for additional draft. Of the 53 voyages monitored, eight experienced a total hull immersion through draft and pitching of more than the 48-foot channel projected depth at zero tide. Hull immersions of 53 feet, 54 feet, and 56.3 feet were recorded.



One conclusion that bar pilots are likely to reach from the study is that the channel is already being overused.

On the positive side, a number of bits of information were developed or confirmed that might help to use the existing channel more fully. With average swell length of 400 feet in deep water and shortening as it rolls in, it appeared that larger and longer ships pitched less and submerged the ends of the hull less because they came closer to spanning more than one swell with their length. More investigation might be done by ship owners, to determine whether ships in the 800-foot range pitch still less (and thereby allow greater draft with the existing channel).

I suggest that one way to use the channel capability better during the 85 out of 100 passages that are not a problem would be to control the loaded draft of bulk vessels in the final stages so the draft would fit the predicted wave and vessel performance characteristic.

When the wave forecast is down, load deep; when it is up, load light. Such a scenario would place a premium on cargoes that load very quickly and that require a loading facility as close to the bar as possible, to reduce the time between loading and crossing.

However, location of any bulk facility in the lower Columbia estuary that requires major alteration of the estuary is unlikely for many years to come unless environmental restrictions change. The recently released Oregon Ports Study indicates the need for at least one new berth per year on the lower Columbia during the next 20 years. Given the present environmental land-use restrictions in Oregon, the increased facilities required must be located further upriver and probably on the Washington side.

Another way to secure the deadweight capacity necessary to reduce the unit cost for cargoes such as coal would be to build ships specifically for the trade on the Columbia River. Design and construction of ships for such an integrated movement would certainly take much less time than that necessary to get a major channel-deepening project through Congress.

To sum up, the constraint on ship draft is the 38-foot bar. The opportunities are really up to the imagination and the ability of those of you whose business it is to move the Columbia River Basin products through the Columbia River ports.

#### Proposed Navigational Improvements at Bonneville Lock

*Adam Heineman*, Chief, Navigation Division  
U.S. Army Corps of Engineers, Portland District

Bonneville Dam was constructed during the 1930's, and the lock size was considered adequate for the then-projected traffic needs. Resolutions by Congress in 1962 and 1967 directed the Corps of Engineers to undertake a study to review the requirements and possible justification for replacement of the navigation lock at Bonneville Dam.



The report was completed in January 1977 after extensive data gathering, model studies on alternative alignments, and public hearings. The study found that the capacity of the present lock will be reached by about 1990, based on conservative projections of traffic growth. Delay in lock passage will continue to grow; by 1990, it is expected that the lock transit time will be about 13 hours, compared to about four hours at the present time. The report recommends that a new lock be constructed at Bonneville Dam with the same dimensions as the larger locks.

In June 1980, Assistant Secretary of the Army Michael Blumenfeld returned the study to the Corps for further work. Based on the administration's position that in developing both our water and resources and our natural transportation system, full consideration be given to nonstructural alternatives, the Corps was directed to review the feasibility of initiating a "congestion fee" that would modify the split of product movement between sail, truck, and barge.

Secretary Blumenfeld suggested that the Corps look specifically at the projected sand and gravel movements. The report indicated relatively lower savings for water transportation on gravel movements compared to other commodities.

New commodities now indicated as possible movements but not considered in the original report (such as coal and protein byproducts of ethanol plants) will be included in the update.

Review of the 1977 projections disclosed that they were conservative. Grain and container traffic have already exceeded the projections for 1980 by a considerable amount.

The present schedule is to have the requested updated material submitted to Washington, D.C., by January 1, 1981. A preliminary report on study results will be given at the Pacific Northwest Waterways Association in October.

#### Omnibus Maritime Act

*Tom Zelenka*

Legislative Representative, Port of Portland

The United States Government has worked to promote the growth and prosperity of the U.S. Merchant Marine, beginning with the first session of the First Congress in 1789. Since then, a long list of tariffs, navigation acts, preference laws, and subsidy programs have been enacted, amended, and repealed in an effort to keep the United States preeminent on the high seas. However, during the 20th century our maritime industries have experienced persistent decay. The 1970's, which were supposed to be an era when U.S. strength



returned to maritime affairs, became a decade of maritime problems aggravated by the 1973 Arab oil embargo, Soviet entry into U.S. trade, and economic recession--to name a few. Therefore, a reappraisal of U.S. policies directed toward an examination of several major issues became necessary: How do we achieve an acceptable minimum of U.S.-flag participation in trades through regulation and promotion? Are maritime affairs part of a transportation or trading system? What is the U.S. free trade policy?

The President's proposals were unveiled July 20, 1979. However, by that time, the House of Representatives had drafted a Comprehensive Omnibus Maritime Act, introduced on July 12 as HR 4769. Finally, adopted as HR 6899, the Omnibus Maritime Regulatory, Reform, Revitalization, and Reorganization Act of 1980 passed out of the Merchant Marine Committee on April 2, 1980. It has yet to come to the House floor for a vote--in large part, because of intense opposition from the maritime industry.

Meanwhile, the Senate Commerce Committee approved its version, SB 2585, on April 18, 1980, and the legislation passed in full Senate on April 24 by voice vote.

A thorough review of the legislation reveals a significant difference between the Senate and House versions. In contrast to the comprehensive regulatory and promotional legislation pushed in the House, the Senate passed out legislation that did not include the controversial provisions of HR 6899.

It is clear that the possibility of significant maritime legislation emerging from the present session of Congress is remote. In other words, things have not changed.

The future of maritime reform legislation is really in coming up with the right questions to ask--not with having the right answers to the wrong questions. Answers to questions that do not recognized changes in technology and trade patterns are doomed to failure.

And it's up to people like yourselves to make greater efforts at examining and evaluating the maritime transportation system--and in developing proposals that result in meshing our domestic needs and our transportation system with those abroad.

#### Foreign Shipper's Perspective

*Archie T. Davis*

Vice President, Transpacific Transportation Company

The Omnibus Maritime Regulatory, Reform, Revitalization, and Reorganization Act of 1980, a bill designed to revitalize maritime policy, reorganize certain



government agencies, and reform regulation of maritime affairs in the United States, has drawn response from both the U.S. maritime industry and the foreign shipping community.

The U.S. industry's response to the bill's statement of objectives, which are "unrealistic and contradictory," is twofold. First, while shipping is highly competitive worldwide, it has tended to be low-return business in the United States. Nothing in the bill offers an explanation on how to induce expansion.

Second, it should be noted that there is conflict between the promotion of American commerce and shipping. The bill sets a goal of 40% U.S.-flag participation in all trades. Such an increase would require massive subsidies and severe restrictions. It would provoke severe retaliation in many countries and would hurt the economies of a number of maritime nations. Also, the bill continually makes mention of national defense requirements, but these are not spelled out.

The European Shippers Councils (ESC) state that they find it difficult to live with clashing jurisdictions, and they deplore the effects of U.S. antitrust legislation, which has ended consultations on the European side of the trade. ESC would have given their entire and unreserved support to the Omnibus Bill if the bill had done more to abolish the many restraints on conferences now imposed upon them by antitrust law and to permit the formation of shippers' councils to act as a strong countervailing power in the United States.

The Council of European and Japanese National Shipowners Associations felt that in the interest of all concerned in the foreign trades of the United States, liner conferences should be able to rationalize their services without fear of exposure to domestic antitrust laws.

In addition, should legislation be passed to authorize shippers' councils in the United States, the foreign lines would regard it with considerable apprehension if the councils should simply become an additional regulatory appendage of the Federal Maritime Commission (FMC) with no strengthening of the conferences.

The governments that compose the Consultative Shipping Group presented their views to Undersecretary of State Richard Cooper. They share similar concerns for the issues previously mentioned (FMC regulatory burden, shippers' councils, and antitrust immunities).

However, additional concerns relate to bilateralism and cargo-sharing; that is, that shipping is best served by a freely commercial regime in all trades and by timely consultation by U.S. authorities about the operation of the regulatory system, particularly when it is proposed to take punitive action against foreign shipowners.

The need for reform is widely acknowledged throughout the maritime industry. Such legislation is viewed by the foreign community as having great potential for improved performance within the industry and improving relations with the United States.

## Influences of the Panama Canal on West Coast Shipping

*Steven R. Gibbs*

Research Assistant Professor, Institute of Marine Studies,  
University of Washington



The ratification of the Panama Canal treaties of 1977 focused attention on the effects of their implementation on containerized general cargo traffic and on whether these cargoes will divert to one of the land-bridge alternatives.

Implementation of the treaties will bring an increase in canal tolls to cover the cost of payments to be made to the Republic of Panama. It has been estimated that the toll increase would be between 14 and 35%. Such an increase could raise the freight rate by an average of \$.84 per metric ton.

The amount of cargo diversion from the canal to land-bridge alternatives, particularly to West Coast ports, will depend on the degree of difference between the all-water and intermodal rates after the toll increase. Presently, freight rates on the two routes are identical, and future rates for both the all-water and intermodal routes are expected to rise by the same amount.

There is no reason to expect that implementation of the Panama Canal treaties, according to the implementing legislation now contemplated, will have any effect on the diversion of Panama Canal cargo to minibridge use, over and above trends already set in. Very little, if any, cargo may divert to the maxibridge, no matter how high Panama Canal tolls go.

It is not clear what will happen to overland common point (OCP) rates when canal rates rise; however, it is possible that some cargoes now using the canal may divert to the OCP route, resulting in gains to West Coast ports. However, this event is likely to be of small consequence for the ports.

On the other hand, a sudden canal closure would probably result in very dramatic increases in demand for West Coast general cargo transshipment services. It is estimated that general cargo tonnage that could potentially be diverted may double the present amount. Actual levels of business at the ports will depend on port, railroad, and shipping-firm pricing strategies and on the ability of the ports and railroads to physically accommodate the demand.

## ENERGY EFFICIENCY COMPARISON OF FREIGHT TRANSPORTATION

*John M. Donnelly, Jr.*

Chairman of the Board, America Waterways Operators, Inc., Arlington, Virginia



The energy expense of water transportation is quite low. Transportation consumes approximately 50% of the energy in the United States. However, only one-half of one percent is used for barge traffic, which comprises a substantial part of water freight transportation.

Energy efficiency can be described in terms of British Thermal Units per ton mile (BTU/ton mile): Freight transportation rail uses 686 BTU/ton mile; truck, 2343 BTU/ton mile; pipeline, 280 BTU/ton mile; and barge, 270 BTU/ton mile.

Other parameters are used to determine energy efficiency:

1. Circuitry, the actual route traveled compared to the shortest route possible between two points.
2. Access to and from main lines of transportation, which can include various combinations of barge, rail, truck, and airplane.
3. Indirect energy use for the manufacture and maintenance of equipment and facilities.

A comparison of all these factors shows that a pipeline is the most efficient transportation mode followed by barge, rail, truck, and airplane.

In the future, research will be necessary for a good analysis of energy use by water freight transportation.

PANEL: INTERMODAL TECHNOLOGY AND COMMODITY FORECASTS--OPPORTUNITIES  
ON THE COLUMBIA RIVER

*Larry O'Rourke*

Former Commissioner, Port of Umatilla, Moderator

Intermodal Commodity Movement

*James R. Jones*

Associate Professor of Agricultural Economics, University of Idaho, Moscow



The adoption of intermodal containerization in ocean transportation has adversely affected the competitive position of Columbia River ports that serve ocean vessels.

Ocean vessels equipped to carry containers are highly capital-intensive, which has moved steamship companies to look to the load-center concept. Under this system, steamship lines restrict their ports of call to as few ports as possible to minimize the time a vessel sits idle in port. The high fixed costs of these vessels make it economical for a steamship line to divert cargo to a few major ports. Among the northern Pacific Coast ports, San Francisco Bay and Puget Sound area ports have gained momentum at the expense of Columbia River ports.

Nevertheless, there are grounds for optimism about the potential role of lower Columbia River ports in intermodal ocean movement. The inland navigation system that provides lower Columbia River ports direct slackwater access to the interiors of Oregon, Washington, and Idaho (and indirect access to regions further inland) adds a new dimension to the intermodal concept. Two new modes of inland water barge transportation--container on barge and shipborne barge--have extended the scope of river transport to intermodal general cargo movements. Both systems integrate inland barge shipments with ocean vessel shipments.

The most promising development in the near future is container-on-barge (COB) service. This concept was pioneered on the Columbia five years ago. At present, 800 to 1000 COB's come down the Snake-Columbia to lower Columbia River ports (mostly to Port of Portland's T-6).

Mathematical models are being used as effective marketing research tools. The transshipment linear programming model is capable of simultaneously considering many important parameters. The analysis identifies least-cost modes and alternative routes, encompassing combined inland and ocean movements under several alternative transportation conditions.

## Intermodalism, Energy, and Rate Structure

*Mike Martin*

Assistant Professor of Agricultural and Resource Economics,  
Oregon State University



The transportation system is an ever-changing scenario. Our present situation is particularly interesting because so many different things are happening simultaneously.

The price of diesel has increased 700% since 1973. This escalating fuel cost is changing the relative efficiency of transportation modes. At \$1.20 per gallon, the fuel cost is \$.0055/ton mile for barge, \$.075/ton mile for rail, and \$.013/ton mile for truck. At \$2.00 per gallon, fuel cost is \$.0075/ton mile for barge, \$.013/ton mile for rail, and \$.036/ton mile for truck.

As a result of rising fuel costs, the transportation system is becoming more synergistic. Managers are looking for least-cost intermodal systems. In addition, government policy design is becoming more sensitive to transportation needs.

Unit trains from the Midwest to Portland are a response to higher costs of energy. The unitization offsets other transportation costs to absorb higher fuel costs. By increasing equipment utilization and reducing turn-around time, costs can be cut 15 to 20% to help make up for fuel cost increases.

The energy question is a springboard to a lot of other questions about transportation economics, such as freight mix, logistics, etc. A system is evolving out of a bunch of independent operators to mitigate higher energy costs. This improved system will help the economic picture of the Pacific Northwest.

### Barge Line Representative's Perspective

*Ken Faris*

Operation Manager, Columbia Marine Lines, Inc.

It appears that food and energy will continue to be a great stimulus to tonnage growth in the foreseeable future.

Exports to traditional customers of Pacific Northwest farm products, particularly grain, are expected to increase. The opening of markets in the emerging Third World and the People's Republic of China should have dramatic effects on the tonnage moved on the Columbia-Snake system.





Energy efficiency, dependency, and self-sufficiency all have one thing in common: continued commodity-growth potential for movement on the Columbia River.

From the standpoint of energy efficiency, waterborne transportation continues to be the most fuel-efficient method of moving the raw materials and semifinished products needed by the nation's economy. This efficiency will attract commodity growth to the river.

From the standpoint of dependency, both national and regional economies are dependent on energy. The traditional fossil fuels of bulk petroleum, while better used, will be increasingly used through at least 1990.

Energy self-sufficiency opens up new vistas of commodity growth on the Columbia. The production of gasohol and the expansion of the coal industry to meet future energy requirements cannot be overlooked.

Modal and intermodal technology will have a great impact on cargo movements in the next 20 years as it has in the past 20.

Container movements on the Columbia continue to increase as improved port facilities combined with intermodal movement offer savings to the shipping public.

The decision to improve--or, conversely, not to improve--the locks at Bonneville will undoubtedly have the greatest single impact on the future of waterborne commerce on the Columbia-Snake system. All available projections indicate a continued growth in amount and diversity of commodities. With a decision to build a new lock at Bonneville, improved technology of modal and intermodal movement will continue.

### Grain Shipper's Perspective

*Richard C. Berger*

Manager, Pacific Northwest Region, Bunge Corporation

Prophesying is always a difficult task--particularly prophesying the future! The grain industry has taken two approaches--the short term, on the order of one to three days, and the long term, extending up to four months. There has been a lack of concern for long term objectives.

The basic grain commodities exported from the Pacific Northwest are white wheat, red winter wheat, spring wheat, and corn. The future for corn holds great promise.



In the 1960's, huge surpluses of grain were moved to needy countries. The 1970's were the decade of the Soviets. The 1980's and 1990's will be the decades of China. With one billion people and growing, China is now the largest importer of wheat. The Chinese have undergone a cultural revolution caused by the need for food rather than political ideology. At present, all of China's good arable land is in use.

India has been self-sufficient in grains for the last five years as a result of favorable monsoons. If they are faced with another drought, their needs will have to be met somewhere.

Before the end of the century, dire predictions about feeding an expanding world population may come true.

On the supply side, agronomists don't predict any major technological breakthroughs in the foreseeable future. The expected breakthrough in hybrids has not occurred. Irrigation can increase supply, but water is not cheap.

The Pacific Northwest is capable of providing a portion of this expanding future demand.

## REPORT ON GOVERNOR ATIYEH'S LOWER COLUMBIA RIVER DEVELOPMENT TASK FORCE

*Larry O'Rourke*

Former Commissioner, Port of Umatilla



The Governor of Oregon has appointed a task force to investigate and promote development potential at the mouth of the Columbia River. Members include William Q. Wick, OSU Sea Grant director; Bud Forrester, editor, The Daily Astorian; Dennis Lindsay, attorney; Jim Thayer, Beaverton businessman (chair); and Larry O'Rourke.

The task force has met with rail and transportation people, overseas buyers, fisheries developers, citizens groups, and others to explore development potential in the estuary area. Its single most significant conclusion is that Tongue Point, just east of Astoria at River Mile 18, is the only undeveloped deepwater port on the West Coast of the United States.

The task force has concentrated its efforts on developing coal transport out of Astoria. The origin of the coal would be Montana and Wyoming, with Utah and the Dakotas in the more distant future.

U.S. coal export shipments are projected to be 100 million tons by 1990 and 200 million tons by 2000, up markedly from the current 8 million tons. Astoria has the potential to ship 5 to 10 million tons annually by 1985.

For the next six months the task force will continue to work with agencies, the Port of Astoria, transportation people, and coal buyers to attempt to get an agreement that will provide for railroad improvement, harbor deepening, and other necessary improvements.

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