Scientific & Technological Benefits

SCIENTIFIC & TECHNOLOGICAL BENEFITS of WINTER DEMONSTRATION VOYAGES on the GREAT LAKES

Report to the Great Lakes Industrial Users Group
and
the Michigan State Chamber of Commerce

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Introduction

There is a growing awareness of the economic imperatives of an extended (perhaps year-round) operating season on the Great Lakes as well as through the St. Lawrence Seaway. As a result, several steamship companies have obtained the cooperation of the federal government in progressive postponements of the closing dates of the locks, etc. Now, some of the industrial users who have much to gain from better transport service are lending strong support to accelerating this development. The federal government is responding favorably and the U.S. Coast Guard and U.S. Corps of Engineers are both involved in appropriate ongoing studies. More recently the Maritime Administration has invited the University of Michigan to submit a proposal for a study of the ship technology and economic factors relating to ice operations.

Of immediate interest is a proposal by the industrial users group to charter a ship for operation on the Lakes this coming winter. The details of the proposal are still unsettled. The

purpose of this presentation, then, is to outline the potential scientific and technological benefits to be derived from such a demonstration project. Our hope is that these various potential benefits will have strong bearing on decisions relating to details of the project.

Potential Benefits

There are many important questions that must be answered before we can assay the overall costs and gains of extending the navigating season on the Lakes. Many of these same questions arise when considering alternative operating methods and ice-freeing systems. A major proportion of such questions could be answered in whole or in part by demonstration voyages this winter. There are, of course, several severe constraints that would apply to ice operations this winter, but that would not obtain in the future. (See Appendix.) Such temporary constraints will inhibit fact-finding, but the proposed project could nevertheless prove exceptionally valuable in advancing the science and technology of winter navigation. It would most assuredly strengthen everyone's hand in preparing for winter operations in 1971-72.

Clearly, a specific ship encountering specific ice conditions will answer important questions as to how effective that particular ship configuration is in forcing its way through ice in those particular conditions. It will also answer questions of structural sufficiency and horsepower sufficiency for that particular ship in those particular conditions. These are spot checks at best. But, under present levels of ignorance, they would represent a manifold increase in our ability to make wise decisions pertaining to extending the season in future years.

These decisions will be based largely on economic studies,

which will, in turn, require increased knowledge of ice-worthy ship technology, scheduling factors, supporting systems, and a number of peripheral problems. Shippers, ship owners, researchers, naval architects, and responsible federal agencies all need answers that the proposed demonstration project might provide. Specifically, these include:

1) What are the capabilities of the present Great Lakes fleet? How late into the winter could the typical unmodified bulk carrier operate, assuming various degrees of icebreaker assistance?

2) What hull, outfit, and machinery modifications would be needed to allow the typical bulk carrier to operate another month (or two or three) beyond that established above?

3) How can an ice reconnaissance center be most effectively organized? What reconnaissance techniques are most economical? How can the information best be disseminated?

4) What are the best organizational arrangements for controlling ship traffic under difficult ice conditions?

5) Exactly how severe are the ice conditions in various key locations at different times of the year?

6) How can navigation be made safe when buoys, etc. are not in place?

7) What delays and slow-downs should be expected in winter operations?

8) What modifications are needed at the locks?

9) What can be done about ice jams that are beyond the capability of icebreakers to clear? Can formation of ice jams be prevented with deflectors, artificial islands, etc.? How extensive need these be?

10) What objections will be raised by the crews, ecologists, ice fishermen, electrical companies, owners of vulnerable shore property, or citizens who habitually walk or ride over frozen waters? How can these objections be met?

11) What emergency measures would be appropriate in case a ship becomes locked in for the duration of the winter?

12) How will winter navigation affect costs of insurance, of maintenance and repair?

13) What changes should be incorporated in the design of new ships if these are to operate for part or all of the winter, with or without icebreaker assistance?

14) What about bow thrusters? Will they help or hinder operation in ice?

15) Will there be serious cargo-handling problems or other problems within harbors?

16) Will air-blower systems (such as on Wårtsilå's Finncarrier) be practical and effective in Great Lakes bulk carriers?

Conclusions and Recommendations

Considering all of the above, I submit the following sets of conclusions and recommendations:

1) Although federal agencies are not yet ready to lend extensive assistance, a demonstration project could nevertheless be extremely worthwhile. It is true that many obstacles will stand in the way of completely successful operations this winter. Nevertheless, postponement tends to lead only to postponement. Experience gained this winter will expedite future advances. The proposal to do our best with what we have this winter is sound and should be implemented.

2) The responsible federal agencies could learn much from the proposed demonstrations and should therefore lend their support. The Mackinaw should be drafted into serving the project to the maximum practical extent.

3) Federal agencies are seldom well-equipped to move fast in cooperative enterprises, particularly where large sums of money are involved. The industrial users group should therefore plan its own program based on minimal federal assistance. (This applies only to the first year's project. Subsequent developments will demand extensive federal cooperation and support. The Canadian government will also be involved.)

4) A maximum range of ship capabilities should be tested

(i.e., both unmodified and ice-strengthened). Therefore, at least two ship types should be used in the project -- plus the Mackinaw. This suggests that the Pittsburgh Steamship Division be urged to extend its January operation even further than currently planned, and that one of the ice-strengthened Canadian tankers also be employed.

5) A wide range of ice conditions should be involved. This should be kept in mind when selecting voyages.

6) In addition to ice-cover information obtainable from air reconnaissance, we need data on the physical characteristics of the ice: its thickness, strength, etc. It would therefore be appropriate for the Coast Guard and Corps of Engineers to undertake an extensive and methodical ice-sampling program throughout the winter. This could involve placing scientific staff aboard all ships involved in the demonstration, helicopter flights, etc.

7) Ice-mapping and sampling efforts would be most effective if planned and coordinated by some central office. The Michigan State Chamber of Commerce already finds itself in a position of leadership in this entire development. It should therefore explore ways of coordinating the ice survey work under the direction of a qualified glaciologist such as E.W. Marshall.

8) Extending the season will require considerable federal support in the future. It will also generate opposition from some quarters. The industrial users group should therefore make a definite effort to generate public interest. It should openly

recognize the merits of the opposition and try to enlist the cooperation of all such groups.

9) The Wårtsilå air-blower system may prove to be economically effective for ships operating in Lake ice. If reasonably possible, one of the project ships should be so-equipped before next winter.

10) There are several navigation aids under development that merit consideration for winter operating conditions. The Coast Guard should experiment with several varieties during the demonstrations.

11) If we are to learn much from the demonstration, the ship owners must be willing to take certain risks. On the other hand, any catastrophic loss or even embarrassing vexations would have unfortunate and exaggerated impact on the long-term hopes for success in extending the season. The project direction must be bold but not audacious.

Costs

If maximum benefit is to be derived from the demonstration, some central research group should be given responsibility for receiving the data, analyzing it, and disseminating the findings. The researchers should study and observe other ice operations; they should provide liaison between all interested parties; and they should furnish consulting services upon request.

The scope and intensity of work envisioned would require the equivalent of about seven man-years for each of the next three to five years -- assuming a continuing program of development over that period. The annual cost of such an activity would probably fall within the range of $200,000 to $250,000, although much could be done for less. (See Appendix for cost breakdown.) All of this would be exclusive of the ice reconnaissance and information service, as well as work already planned by the Coast Guard, Corps of Engineers, and Maritime Administration. It would rely on others for ice-sampling, log-recording, and other field operations since we assume such activities could be handled by the Coast Guard or Corps of Engineers as part of their own studies.

The figures cited above would not cover any physical modifications to the ships, charter fees for experimental use of ships, or extra charges (such as insurance) for winter conditions.

In budgeting the project, additional funds should be earmarked for perhaps 10 ship-days of experimental operation at about $5000 per day.

APPENDIX

Constraints

A demonstration project this winter would apparently have to operate under several serious constraints that might not obtain in future years. These are:

1) No additional USCG icebreakers will be available. The one major icebreaker that is stationed on the Lakes will not be abailable full time and may be available only for emergencies.

2) No special ice-freeing measures (such as bubbler systems or special locking devices) will be operationa.

3) The federal government will not be responsible for ice-freeing any harbors.

4) No major preparatory modifications will be made in the ship(s).

5) Navigation aids will be largely out of service.

6) Insurance rates will be abnormally high.

7) There will be little if any special protection for vulnerable waterfront property.

8) Ice reconnaissance services, if any, will be largely untested and subject to developmental bugs.

APPENDIX (Continued)

Cost Estimate

		Annual Cost
1 Director @ $25,000		$ 25,000
1 Asst. Director @ $18,000		18,000
2 Engineers @ $14,000		28,000
1 Junior Engineer @ $10,000		10,000
2 Secretaries @ $6,000		12,000
	Sub-Total:	$ 93,000
15% Staff benefits		14,000
	Sub-Total:	$ 107,000
Overhead @ 65%		70,000
Travel: 25 @ $80		2,000
Computer time		5,000
Consultants		15,000
Report duplication		1,000
Phone, postage, miscellaneous		2,000
	TOTAL:	$ 202,000

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