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GREAT LAKES SHIPPING, TRADE, AND AQUATIC INVASIVE SPECIES

Carrots and Sticks

Opportunities to Accelerate the Development and Adoption of Ballast Water Treatment Technologies for Vessels Operating into the Great Lakes

Prepared for
Committee on the St. Lawrence Seaway:
Options to Eliminate Introduction of Nonindigenous Species into the Great Lakes, Phase 2
Transportation Research Board and Division on Earth and Life Studies

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Contents

INTRODUCTORY REMARKS

The objective of this paper is to explore ways to advance the introduction of an effective ballast water management regime for the Great Lakes, and in particular to examine whether the provision of incentives, either in the form of 'Carrots' or 'Sticks', might serve to accelerate this process. It will be appreciated that, in order to examine any such acceleration possibilities, there is first a need to understand what constitutes the principal elements (activities) of the process, and how long it might take to complete those activities if no special efforts are made to accelerate it. Again there is a need to evaluate the degree to which this process is, in fact, amenable to acceleration, and finally to explore whether the provision of various economic, political, legal or regulatory incentives could make a substantive contribution to this acceleration.

This initiative is in support of the work of the National Academies' Committee on the St Lawrence Seaway which has been tasked with examining options to eliminate the introduction of non-indigenous species into the Great Lakes. Phase II of this project involves the identification and exploration of options for the Great Lakes region that not only enhances the potential for global trade in the Great Lakes region but also eliminates further introductions of non-indigenous aquatic species into the Great Lakes. In support of its work the Committee is expected to commission papers, hold a symposium during which these papers are to be presented and discussed, and ultimately to develop a range of practical and technically feasible options that meet the project criteria. The Committee's final report is expected to comment on the strengths and weaknesses of the options identified and to suggest approaches that seem most promising for more detailed evaluation and possible implementation.

This initiative constitutes one of these commissioned papers. The time constraints imposed on the Committee has meant equivalent constraints on the conduct of this study, which as a result has had to be undertaken in a very tight timescale. It is therefore important to appreciate that the time available to complete the work has precluded the development of a truly comprehensive and definitive appreciation of each and every aspect of the ballast water management development process and the timing considerations bearing on its introduction. Because of these time limitations there are no doubt aspects of the implementation process and timing that have either been omitted or not fully or accurately described. In this respect the paper offers more an illustrative methodology for use in analyzing the process rather than a comprehensive and accurate description of that process and the timing associated with its implementation.

That said, it is the view of the author that, despite these important qualifications on the conduct of the study, its essential findings, addressing whether there is potential for accelerating the process through the provision of incentives, are nevertheless valid, for the reasons set out in the Section 7 – Summary and Conclusions.

The author would like to thank sincerely the many people who kindly took the trouble to offer invaluable advice regarding this complex exercise. In the US these included Victoria Huyck, Richard Everett and Bivan Patnaik of the US Coast Guard, Kathy Metcalf of the Chamber of Shipping of America, and Margaret Blum, Michael Carter, Wassel Mashegbeh, Carolyn Junemann, Richard Lolich and Lane Nemirow, of MARAD. In Canada, the author is also indebted to Tom Morris of Transport Canada Marine Safety, Valarie Devlin and Neil Kochhar of Transport Canada Marine Policy, and Ray Johnston of the Chamber of Maritime Commerce.

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Any misrepresentation in this paper of this most helpful advice is entirely the responsibility of the author.

Carrots and Sticks

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1. WHAT'S THE GOAL? INTRODUCTION AND BACKGROUND

1.1 The Problem

The starting point for this study is the recognition that there is a serious problem in relation to shipping on the Great Lakes arising from the reality of two circumstances which appear, at least in the first instance, to be basically incompatible. These are:

- The serious threat to the Great lakes arising from the introduction of further alien invasive species or pathogens as a result of the discharge of ballast water from ocean-going ships.
- The critical importance of such shipping to the commercial health and success of the region

In addressing the challenge presented by this apparent incompatibility, there would seem to be two basic options (both of which present significant issues):

- Ban ocean-going shipping from the Gt. Lakes, and shift to land alternatives for transportation
- Through various technological and procedural means, effectively eliminate the threat posed by ballast water while allowing ship operations to continue

While the first option continues to be examined, there are indications that this would be very challenging and involve considerable additional expense, congestion and environmental degradation. The second option is therefore emerging as preferable so long as the goal of effective elimination of risk can be achieved, and the remedy can be introduced quickly and efficiently.

1.2 Activities to Date in Addressing the Problem

Initiatives have been taken at a number of levels directed at making this second option work. At the international level the International Maritime Organization (IMO) has adopted (as of February 13, 2004) the *International Convention for the Control and Management of Ship's Ballast Water and Sediments* (hereafter referred to as the Ballast Water Convention or Convention) This Convention, which now awaits ratification, calls for adoption of prescribed standards over a seven year period from 2009 to 2016. While progress is being made on a number of fronts to develop and provide the necessary technological performance and associated

regulatory and governance infrastructure, there are signs[1] of growing concern at IMO and in other quarters that the rate of this progress is unlikely to be sufficient to ensure entry into force of the Convention in time to meet the implementation dates for the prescribed convention standards, at least in the early years. This is further discussed later.

There is also concern in a number of quarters that, while these performance standards constitute a marked improvement over present management procedures, the particular fragility of the Great Lakes raises questions as to whether the standards are sufficiently stringent to achieve the effective elimination of risk.

Nationally in the US, significant research and development is being undertaken and a regulatory development initiative has also been launched. While work at the national level in the US has been approved in principle by Congress, and is being given high priority, (see further details below) no final target performance measures or target dates for the implementation of the necessary standards have yet been prescribed. Nationally in Canada, initiatives parallel those being pursued in the US, but on a smaller scale.

At the US state level, initiatives are either under consideration, or have actually been taken unilaterally by certain US states. This approach has a number of serious drawbacks, but will continue as a possible threat to uniform national or international standards so long as there is concern about the speed of progress at the national and international levels. There has also been heightened interest in the province of Ontario, including the attempted introduction of draft legislation into the provincial legislature, but the clear assignment of marine matters to the federal government in the Canadian Constitution places significantly greater limitations on the authorities of governments below the national level, when compared to the US.

With regard to the marine transportation industry, the potential threat to continued ocean-going shipping operations posed by certain of the options to solve the invasive species issue has served to stimulate significant efforts to find a solution. The shipping industry, particularly that element engaged in international deep-sea trade, has launched a number of important technological research and development projects, and has collaborated with government on a number of others. The clear position of industry representatives on both sides of the border is that they strongly support the application of a ballast water regime that responds to the environmental needs of the Lakes while enabling shipping operations to continue. Their principal preoccupation and concern is that the solution be workable, affordable and predictable.

Of course a second industry sector with an interest in the ballast water treatment issue is that which is involved in the development and production of the treatment equipment. From discussions with representatives of this industry, it is clear that, once it has been made clear as to what standards will apply, and the necessary certification provided that their equipment meets those standards there will be a large market for their product.

1.3 The Aim of This Exercise

As a consequence of the adoption of the Ballast Water Convention, there is an unfolding sequence of events directed at introducing the improved performance standards for ballast water management that it prescribes. However, not only is there considerable uncertainty with regard to the timing of that introduction, but until further advances have been made in the technological development of ballast water treatment equipment, it is not clear that the standards are

[1] For example, see Fairplay, *Solutions and New Buildings Magazine* dated November 2, 2006, ‘MEPC makes progress.

sufficiently stringent, or emerging at a sufficiently timely rate to meet the special needs of the Great Lakes.

The aim of this exercise, then, is to take stock of progress so as to make a best estimate as to the likely timing of implementation of the steps necessary to ensure adequate protection of the Great Lakes from ballast water contamination. In the likely event that this timing is seen to be inadequate, the aim is also to examine whether there is any scope for accelerating the provision of this protection, and if so to examine whether such acceleration might be achieved through incentives to encourage more rapid adoption of the necessary measures ('carrots'), or directives to force more rapid adoption ('sticks').

Put quite simply, the exercise is directed at establishing whether the implementation of an acceptable Great Lakes ballast water management regime is happening fast enough, and if not how things might be speeded up.

1.4 A Word About Flag

The US (and to a lesser degree Canada) have important coastal (coastwise) transportation activities (that are therefore reserved for national flag vessels) moving over comparatively long distances, (and therefore between marine ecosystems that may differ quite markedly) and involving cargo movements that give rise to the need for ballast water management activities. Movements between Alaska or Hawaii and the US West Coast are good examples. There is therefore an important need for both Canada and the US to advance national regulatory and other requirements for ballast water management, as Flag States

However, the large majority of ships entering or leaving the Great Lakes with trans-ocean origins or destinations are foreign flag vessels. Thus the regulation of such ships by the US and Canada would be principally in their respective capacities as Port or Coastal States as opposed to Flag States. In this respect the route by which US and/or Canadian research and development efforts might orchestrate higher ballast water treatment performance in ocean-going ships operating on the Great Lakes, would be less direct than as a Flag State.

In other words, should more stringent standards or more rapid implementation be the objective, not only would ways need to be found to ensure that these requirements are imposed (by regulation) on such foreign flag vessels, but there would also be a need to ensure that the necessary technology, capable of achieving the more stringent standards was made available to the owners of such foreign-flag ships (which may or may not be US or Canadian owned) in the necessary timescale so as to equip them to meet the imposed regulations. This would be important because it is reasonable to expect that the focus of effort of international research and development would be almost exclusively directed at meeting the standards and/or timing called for in the Convention.

What follows takes a closer look at these quite complex issues.

2. HOW DO WE GET THERE? THE PROCESS

2.1 Defining a Framework for Analysis

In order to evaluate the potential for acceleration of the process, there is of course a need to understand the process itself. More particularly, in circumstances where a world-wide effort is

being directed at finding a solution to the problem, and where governments have obligations to both those who seek protection from the risks of environmental damage posed by ballast water, and to those whose livelihood depends on shipping operations and the commercial activities such operations support, there is a need to understand where various initiatives 'fit' in the cross section of development activities directed at finding a solution to the problem.

It is suggested here that the analytical process might be assisted by breaking down the various initiatives into three basic groups. The first group may be viewed as involving those initiatives that are associated with a State's efforts to advance the ratification and entry into force of the IMO Ballast Water Convention. Whether or not a State (be it the US, Canada, or another nation participating in the development of the Ballast Water Convention) ultimately decides to ratify it, that State has an obligation to evaluate the degree to which it can conform to the Convention, and to seek ways in which any regime adopted outside the provisions of the Convention, is made as compatible as possible with those provisions. In short, there is an obligation on all States to do their best to make the Convention work. This obligation extends to the stimulation of the necessary research and development sufficient to enable the evolution of the necessary technology and equipment capable of achieving or exceeding the Convention's performance standards. For purposes of this exercise, this range of activities is grouped under the label '**State Party**' activities, albeit recognizing that States may not yet be party to the Convention.

To the degree that pursuit of ratification requires the investment of time, money and effort in order to develop the necessary treatment technology, and ultimately the manufacture of equipment capable of treating ships' ballast water to the required standard, so this group would need to address itself to a program of research and development that would be undertaken in collaboration with industry. In this respect, any examination of the potential acceleration of the process would also need to recognize this and accommodate the joint involvement of government and industry

A second group involves those activities associated with a State's efforts to ensure that its concerns regarding possible environmental and safety threats posed by ballast water are fully addressed. In this situation the nation may be viewed as fulfilling responsibilities normally associated with those of a **Coastal State** or **Port State**. The principal aim of this group is to evaluate as accurately as possible the nature and degree of the threat posed by ballast water, and more particularly to examine the degree to which these threats would be removed by application of the Ballast Water Convention performance standards. Should it be found that the standards that should be applied to achieve effective removal of the threat are more stringent than those called for in the Convention, this does not necessarily exclude ratification, since the Convention provides for States to apply 'additional measures',[2] but the possible requirement to obtain approval of the Organization[3] before applying these standards may complicate the ratification process. In any event it is important to recognize that these initiatives are pursued largely independent of the Convention, at least in the early stages.

A final group involves those activities associated with a State's efforts to fulfill its responsibilities as a **Flag State**. In this role it is the responsibility of the State to ensure that the owners or operators of ships flying its flag are provided with the necessary information and

[2] Annex to the *International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004,* Section C, Regulation C-4, para. 1

[3] Annex to the *International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004,* Section C, Regulation C-4 para 3.3

support to enable them to equip and operate their ships using ballast water management equipment capable of, and certified as, meeting or exceeding the performance standards called for in the Convention. It is also the responsibility of a Flag State to ensure that it has the necessary data, governance infrastructure and competencies to validate and certify the equipment carried on ships flying its flag.

The processes that need to be followed by each of these groups will be addressed in turn.

2.2 State Party Activities

The starting point in relation to the Convention is the performance regime and associated timing set out in its provisions. Whether or not individual States may hold views regarding the adequacy of that performance regime, this is no longer open for international debate, and recognizing that the text of the Convention has now been 'adopted', clearly the focus of effort is expected to be directed towards advancing ratification by the necessary number of States that together constitute the requisite percentage of world tonnage[4]. An important characteristic of this Convention is that the technology needed to achieve the performance standards that it prescribes was not developed and available at the time it was adopted. In this respect a fundamental prerequisite for ratification by States and ultimately entry into force is the ready availability of equipment that is certified as at least achieving the Convention's performance standards. Thus the dominant focus of endeavour here is the investment of time, money and effort in the development of this technology.

There are two important components to the technological challenge.

- The first of these components is the research and development, normally in a shore based environment, of the technology capable of meeting or exceeding the treatment standards set out in the Convention, as well as the certification, or 'type-approval', of this equipment.
- The second of these components is the 'operationalizing' of the technology so that it is readily available and suitable for use in a ship-board environment. More particularly this involves adaption of the technology to meet a wide range of shipboard conditions, such as ship size (and therefore quantity of ballast water), available on-board space (and therefore possible limitations on equipment size), power requirements, sensitivity to motion, etc. This component also embraces the need for personnel training and certification to operate the equipment as well as the necessary maintenance and upkeep directives in order to ensure that the equipment is operating satisfactorily. Again there is a need for some process of operational certification to ensure these requirements are met.

In support of this effort IMO has developed and promulgated a number of 'Guidelines' in order to ensure uniform implementation of the Convention. As of early 2007, the majority of these guidelines had been finalized. Notable exceptions include the guidelines governing additional measures which are expected to address the procedures that should be followed when a State chooses to apply more stringent performance standards. These guidelines are important in that they will likely decide whether or not a State (such as the US or Canada) will feel able to ratify the Convention, should either (or almost certainly both) States choose to apply more stringent standards in waters such as the Great Lakes.

[4] The Convention will enter into force 12 months after ratification by 30 States, representing 35% of world merchant shipping tonnage.

It should be noted that this technological development effort is not limited to, or even necessarily focused in, States with large nationally flagged fleets. Indeed much of the present investment of effort in technological research and development resides in States with comparatively small national ocean-going flag fleets including, for example, Sweden, Japan and Korea. The Convention requires that 'Ballast Water Management systems used to comply with this Convention must be approved by the Administration taking into account Guidelines developed by the Organization'.[5] Thus for Flag States which are principally concerned with equipping their ships, but which may not be extensively engaged in the necessary technological development, it will be essentially a two step process. First the 'Administration'[6] of the State where the technology is being developed will approve and certify the equipment as meeting or exceeding the convention standards, and then the Administration of a second (Flag) State will need to satisfy itself that the approval process of the (Administration of the) first State may be relied upon and that the equipment can then be approved for its own ships. This, of course also requires the extensive availability of comprehensive equipment performance data.

The point being made here is that for an equipment manufacturer to feel able to invest in an extensive manufacturing initiative, it must be sure that ship-owners can have full confidence that the equipment to be manufactured will meet the standards to which their ships will be required to conform. In most cases this requires transparent and reliable certification processes by both of the administrations involved.

Under the terms of the Convention, States party are required to approve and certify treatment equipment (as called for under the G8 and G9 guidelines[7]). States must therefore clearly commit to establishing the necessary capacity to perform this function.

A further technological challenge is that associated with the taking and testing of samples to ensure compliance. While there is generally no serious problem in taking samples, or indeed in ascertaining that the sample meets the prescribed standards, there may be problems in accomplishing this in a timescale that does not involve a delay to the ship. Ways need to be found to ensure that this not occur.[8]

Finally it should be noted that the Convention contains provisions that require States Party to ensure that ports and terminals where cleaning and repair of ballast tanks occurs, have 'adequate facilities for the reception of sediments.'[9] At issue, of course is exactly what constitutes 'adequate'.

The process is illustrated in Diagram 1.

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[5] Ballast Water Convention Annex, Section D, Regulation D-3, *Approval requirements for Ballast Water management Systems*, Paragraph 1.

[6] See Article 1 of the Convention for definition.

[7] G8 addresses approval of ballast water systems, while G9 address the approval process for systems making use of active systems.

[8] As will be discussed later, this last challenge takes on more importance in circumstances where more stringent performance standards may be called for, since this would give rise to the need for higher performing test equipment that was capable of testing to the higher standard, still within a timescale that would not delay the ship.

[9] Ballast Water Convention, Article 5

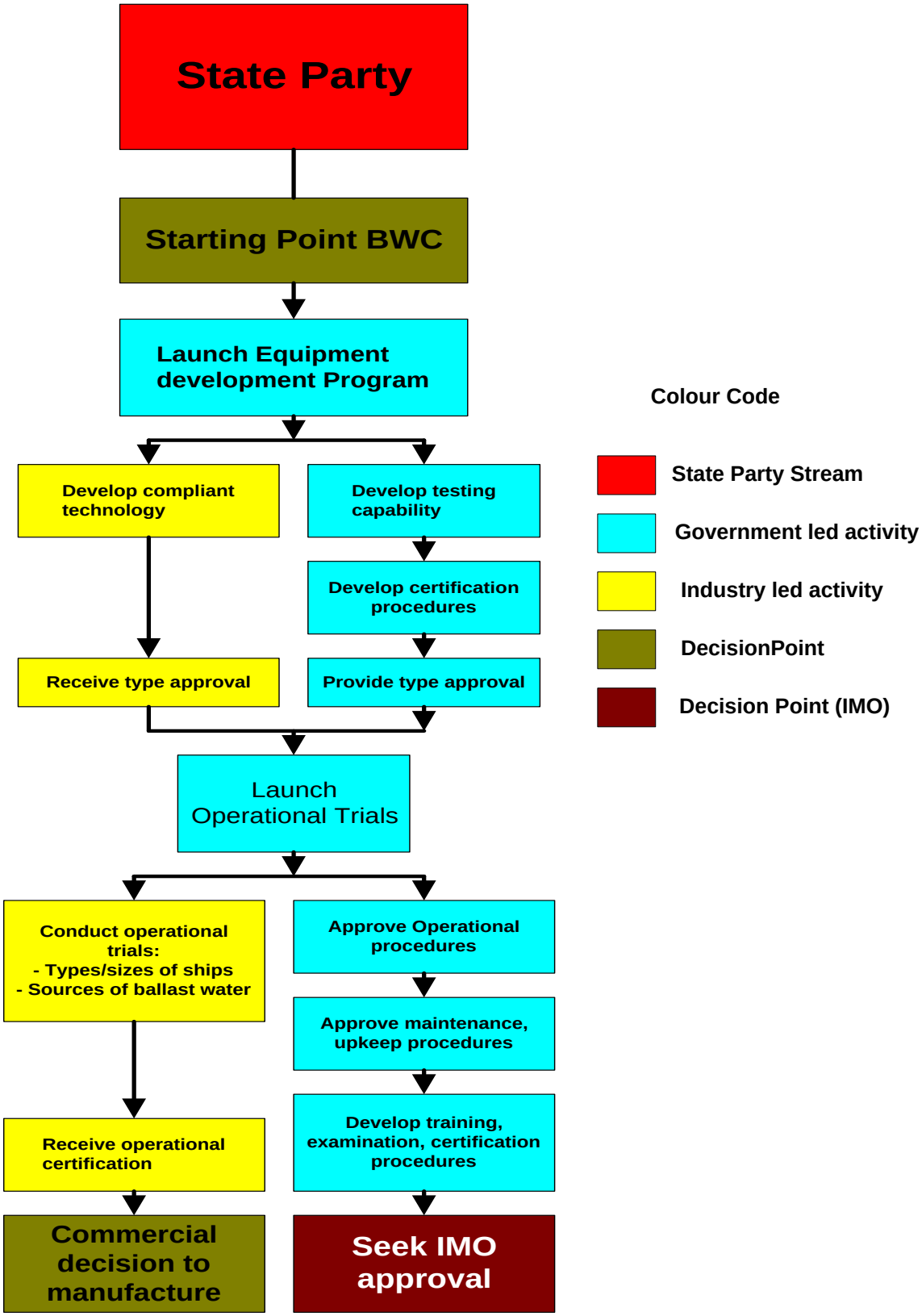

Diagram 1 State party flowchart.

2.3 Coastal/Port State Activities

The preoccupation of this second group of activities is largely separate and distinct from the first group, and as suggested earlier, is associated with a State's efforts to ensure that its concerns regarding possible environmental and safety threats posed by ballast water are fully addressed. In this respect the starting point is some form of broad risk analysis to establish the nature and degree of the potential hazard posed by ballast water (especially in specific locations having certain unique features such as the Great Lakes under consideration here) and to evaluate the conditions (principally the quality of the ballast water being discharged) that effectively eliminates the possibility of such a hazard arising.[10]

In this respect it may be seen that these activities serve to 'revisit' the background scientific work that was undertaken internationally in support of the standards agreed upon for the Ballast Water Convention. At issue in this activity stream is whether the Convention performance standards achieve effective elimination, or whether some more stringent standard is considered necessary.[11]

The exercise involves not only analysis of the environmental consequences of adopting certain standards, but also their economic consequences, since any standards that are more demanding than those called for in the Convention would mean that ship-owners would be faced with choosing between fitting their ships with higher performing equipment or no longer trading into the Great Lakes. The exercise would likely take the form of an Environmental Impact Analysis (EIA).

It is one thing for a group of scientists and economic analysts, however competent, to prepare an EIA; it is quite another to have it accepted as national policy. Thus the democratic process demands that the public have an opportunity to comment upon the findings, and in particular the acceptability of any proposed standards.

Again, to the degree that policies adopted by one State may impact upon another, there is clearly a need to consult with neighbouring States to ensure that there is a workable formula for the application of more stringent standards. It is to be noted that this obligation to consult is set out in the Convention.[12]

Ultimately the product of these efforts is the approval of national performance standards. Should these standards be more stringent than those called for in the Convention, then the State is expected to communicate this requirement to IMO at least 6 months prior to the projected date of implementation.[13] This would not only apply in the case where the State has ratified the Convention, but also if it wishes to maintain the possibility of doing so, or at least, even if not ratifying, wishes to conform to those provisions of the Convention that it is able to support. Furthermore, as indicated earlier, the State is expected to obtain the approval of IMO 'to the extent required by customary international law as reflected in the United Nations Convention on the Law of the Sea (UNCLOS).[14]

The approval of national standards would complete the policy work, but would then trigger the need for regulatory enforcement and the provision of the organizational infrastructure

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[10] It is suggested here that 'effectively eliminates' be interpreted as reducing the level of risk below that posed by other substantive vectors identified as having the potential to introduce alien species

[11] There would appear to be no realistic scenario that would call for standards less stringent than those called for in the Convention, even though it is understood that the US is including a 'status quo' option.

[12] Annex, Section C- Special Requirements in Certain Areas, Regulation C-1, Paragraph 2.

[13] Annex, Section C- Special Requirements in Certain Areas, Regulation C-1, Paragraph 3.2

[14] Annex, Section C- Special Requirements in Certain Areas, Regulation C-1 paragraph 3.3

and associated funding to perform that function. This could possibly trigger the need for new legislation or at least legislative amendment. Such a requirement would, as an essential part of the legislative process, also need to include discussion, agreement, and ultimately clearance approval from a wide variety of national departments and agencies. Then, and only then, would the State be in a position to implement the program.

It should be noted that application of more stringent standards would in all likelihood effectively trigger a new start for those activities identified under 'State Party' above, and as set out in Diagram 1, since, until the announced intent to apply more stringent standards, there would have been no call for the technology to meet them. Again for consideration, is whether a comparatively limited market for ship operations, such as the Great Lakes, would be sufficient to trigger the international investment of money and effort needed to stimulate the development and manufacture of such equipment. It may therefore be for the port/coastal State that is imposing the measures to ensure the development and certification of equipment capable of meeting those measures. This Coastal/Port State process is illustrated in Diagram 2.

2.4 Flag State Activities

The preoccupation of this third group of activities is again separate and distinct from the previous two groups, and, as stated earlier, is directed at ensuring that the owners or operators of ships flying its flag are provided with the necessary information and support to enable them to equip and operate their ships using ballast water management equipment capable of, and certified as, meeting or exceeding the performance standards called for in the Convention.

In those circumstance where the exercise only involves implementation of the Convention, the exercise, at least in relation to new ships, would be principally one of validating the performance of ballast water treatment equipment on the market to ensure that this performance meets or exceeds those set out in the Convention, and ensuring that those ships flying the flag of the State conform to this new requirement.

However, there may also be important implications for existing ships operating on coastal routes (whether or not on cabotage movements). Prior to ratification of the Convention and the resulting availability of treatment equipment, and recognizing that these ships were operating on routes that never took them far enough off shore to allow for efficient ballast water exchange, such ships would, to date, have been provided with exemptions. With the activation of an obligation to fit treatment systems, this exemption would no longer be justified, since there would be no need to conform to the deep water requirements called for in the exchange process. Therefore presently exempted ships would need to conform to the requirement to fit treatment equipment. This could constitute a significant expense for marginal operators, and would need to be properly evaluated and understood as part of the ratification process.

It should be noted that the Convention does provide for the granting of exemptions,[15] but this is limited to waters under its jurisdiction, and under quite prescribed conditions, and any such exemption only becomes effective following advice to IMO regarding the granting of the exemption.

The situation is rendered considerably more complicated for the Flag State as and when a Port/Coastal State chooses to impose more stringent performance standards on routes or origins/destinations frequented by ships of that Flag State. In such circumstances, not only must ships registered with the Flag State acquire and effectively operate the higher performance

[15] Ballast Water Convention Annex Section A – General Provisions, Regulation A-4

equipment, but the Flag State will presumably need to equip itself to validate and certify such equipment. In this respect it will not only need to be capable of certifying equipment meeting the performance standards set out in the Convention, but must also provide validation and certification services for ships wishing to meet the more stringent standards prescribed by a particular Port/Coastal State. In circumstances where the Port/Coastal State and the Flag State are one and the same, this may be seen as worthwhile. However there is substantially greater doubt that a Flag State that has only seen it as necessary to ratify the Convention and commit to adherence to its standards, will be prepared to equip itself to provide certification services for more stringent standards. Of course, should it be possible for a ship to satisfy the Port/Coastal State that its equipment meets the more stringent standard, despite the absence of Flag State certification, then no doubt it could be authorized to operate in the internal waters of the Port/Coastal State.

As to how this complex process will play out remains to be seen. It may be that those Port/Coastal States choosing to impose more stringent standards will not only need to provide the research and development effort necessary to achieve the higher performance requirement, but may also need to provide some stimulus to industry in order to encourage the manufacture of such equipment for what may be a limited market. Port/Coastal States may also need to collaborate with leading Flag States (especially leading open registry States) to make it worthwhile for the Administrations of such States to invest the time and effort to develop and maintain the capacity to certify, to the more stringent standards, those ships flying their respective flags and wishing to trade in regions where the more stringent standards apply. This Flag State process is illustrated in Diagram 3.

3. WHAT'S GOING ON? OVERVIEW OF CURRENT ACTIVITIES

By way of introduction to this section it should be made clear that what follows is not a comprehensive overview of current activities in ballast water management. Such an overview would be significantly beyond the scope of this quite limited study. It is also recognized that the mention of some activities while no doubt omitting others may even run the risk of being to a degree misleading. Furthermore the situation is changing rapidly from day to day, and so may not reflect important developments occurring after the generation of this 'stock-taking' exercise

In this respect the reader is cautioned regarding what follows in this section, and is advised to regard the material as *illustrative* of the work currently being undertaken rather than presenting a complete and accurate picture of where things stand. With this important qualification, the purpose of this section may be stated as to provide some substantive insights into work currently under way in the various sectors described in Section 2, as a prelude to examining the associated timing expectations, the potential for acceleration, and ultimately the potential for application of possible 'carrots' and 'sticks'.

3.1 International Activities

As indicated earlier, much of the international endeavour is presently being directed at implementing the Convention, and in this respect falls within that group of activities to which States are addressing themselves as States Party, as defined in Section 2.

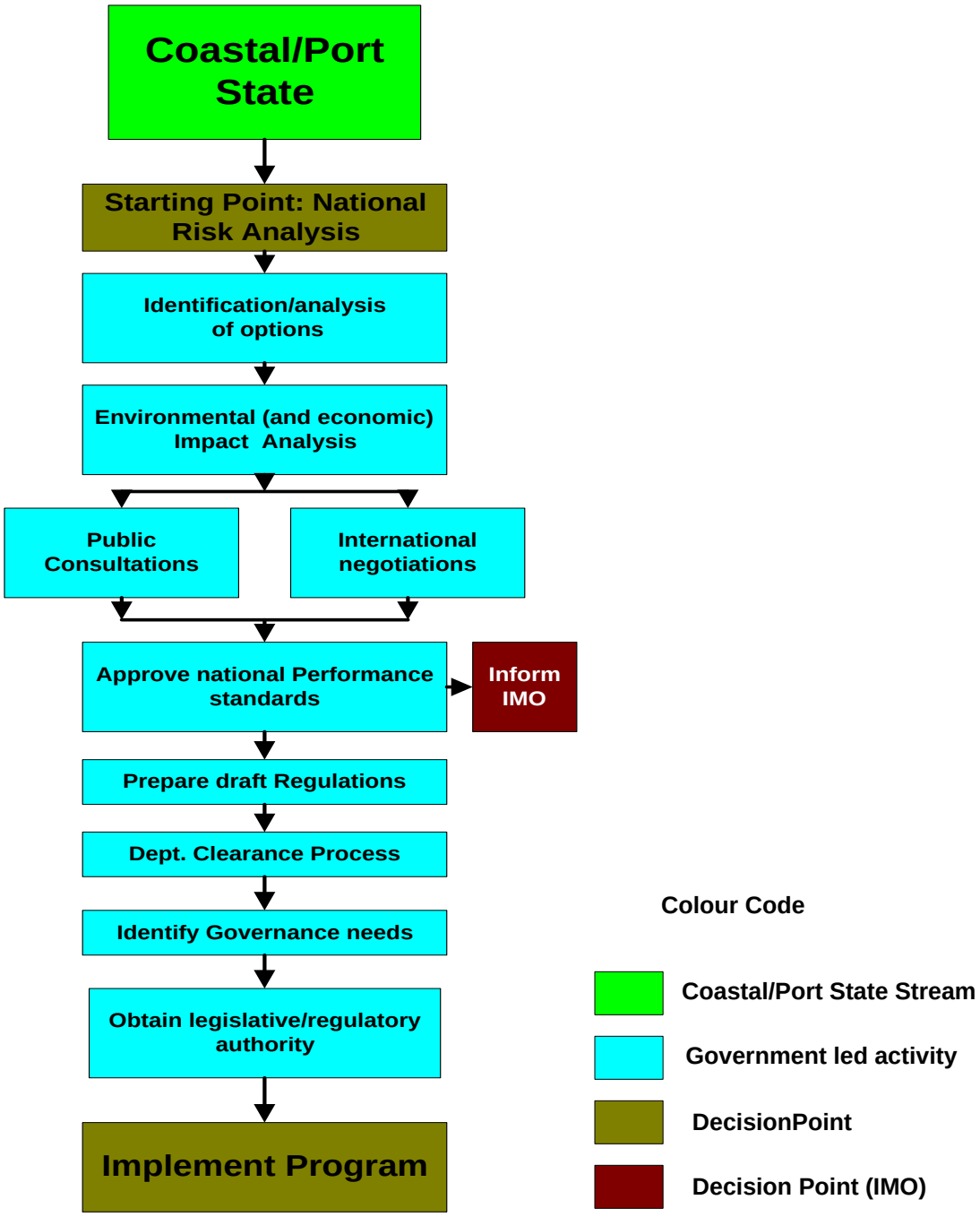

Diagram 2 Coastal/port state flowchart.

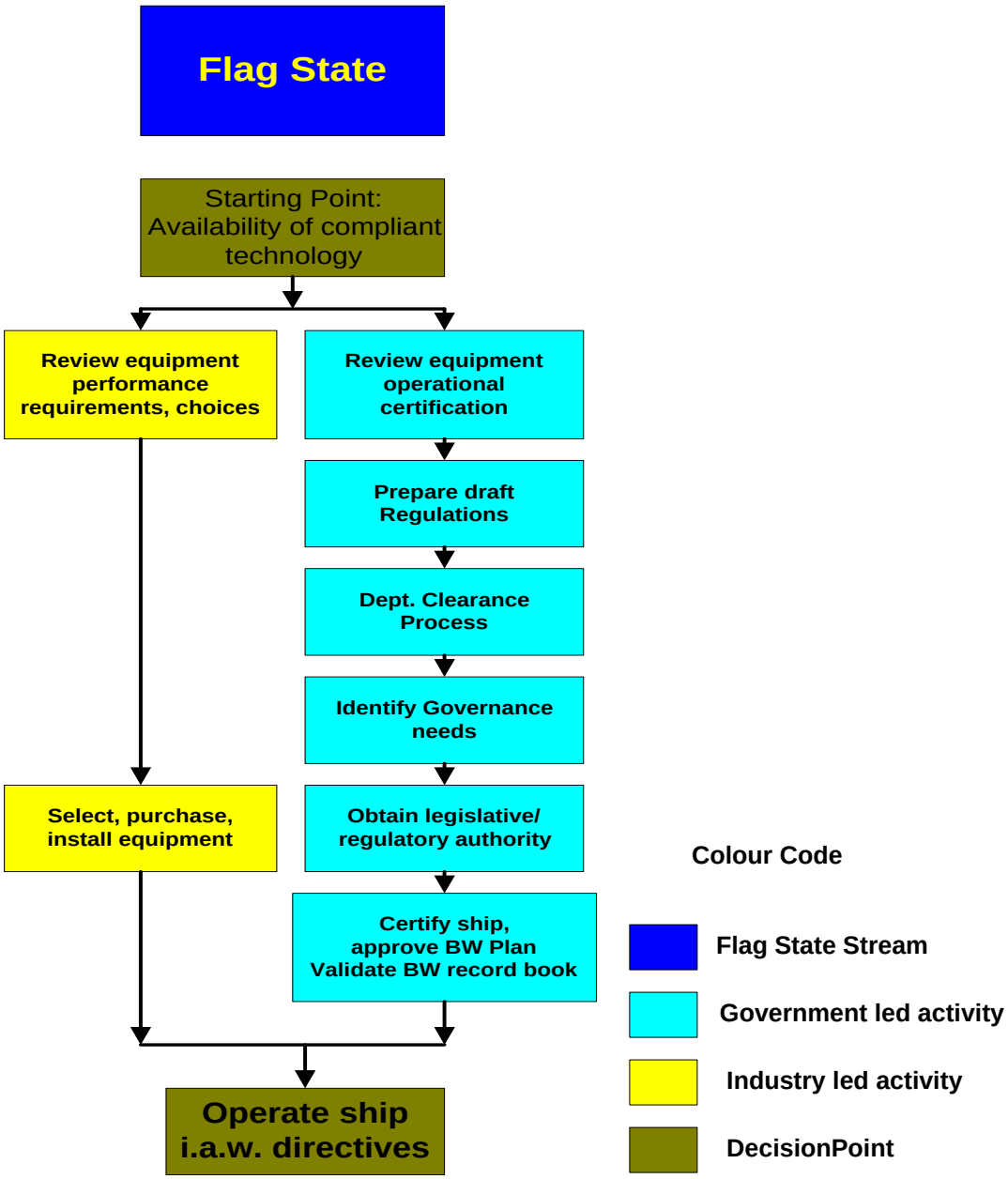

Diagram 3 Flag state flowchart.

Mention of much of what has been going on in relation to international activities has been touched on briefly in the previous section. Suffice it to say here that the Convention, which prescribes performance standards for ballast water and sets out a detailed implementation timetable, was adopted on Friday, February 13, 2004, and now awaits ratification. Entry into force will occur one year after the date where 30 States representing 35% of world tonnage, have ratified the Convention.

In the meantime a working group of experts drawn from member States, together with observers from intergovernmental organizations and international non-governmental organizations, all under the auspices of the Marine Environmental Protection Committee (MEPC) of IMO, has been engaged in the development and issuance of fourteen sets of Guidelines, directed at ensuring the effective and uniform implementation of the Convention. More particularly the Guidelines are intended to provide Flag Administrations and Coastal/Port State authorities with guidance on various procedures and principles, all directed at achieving, as far as is possible, a single uniform and cohesive approach to minimizing the risk of ballast water contamination. As of late 2006, eleven guidelines had been adopted, with three still to come. At its meeting in October 2006 the MEPC instructed the Sub-Committee on Bulk Liquids and Gases to finalize guidelines on additional measures, which will include procedures for the application of more stringent standards.

It is to be noted[16] that the Ballast Water Review Group, tasked with monitoring progress towards implementation of the Convention, met at this meeting to assess progress, and in particular to assess whether appropriate technologies, capable of achieving the ballast water performance standards would be available to meet the timetable for compliance by the first group of ships in 2009. This assessment indicated that while type-approved systems would 'probably' be available for installation prior to the first application date, the actual installation on vessels expected to be on order or under construction at that time, may either not be feasible or only possible at excessive cost. It was noted that the granting of exemptions or processing of amendments could only be satisfactorily accomplished once the Convention had entered into force, and States Party were being urged to accelerate the ratification process.

While there is clearly some concern in IMO regarding progress in technological development, several systems, designed to achieve the necessary performance standards, are emerging. Examples include the Electro-clean system from South Korea and Hamann's SEDNA system from Germany. Another recently announced development completion is Swedish based Alfa Laval's PureBallast system developed in collaboration with Wallenius Water. As these systems emerge there is clearly a key requirement to ensure that related technological information is made available to other Flag and Port/Coastal States. To support this need, all Administrations are being asked to report at the next MEPC meeting in July 2007, on the existence, utilization, capacity, accreditation and capabilities of their facilities.

In summary, the international course of action has been largely agreed upon in the form of a Convention, and implementation of that Convention is advancing. There are a number of important challenges that are being addressed, and progress is being made. Nevertheless, there appears to be some risk that the timetable reflected in the Convention may be difficult to meet, at least in the first couple of years of the implementation schedule. The principal element of uncertainty at the moment is the apparent slowness of States to ratify, and of course this in turn impacts upon the date of entry into force. It is clear that the ratification requirements must be

[16] Record of the meeting of MEPC 55 dated 9-13 October, 2006

met by the end of this year if the Convention is to enter into force in time to apply the first convention obligations.

3.2 US Activities

While the US, in its capacity as a State Party as explained in Section 2, is actively supporting implementation of the steps necessary to bring the Convention into force, it is not viewing the Convention as the only, nor even necessarily the best, way ahead. In this respect it is currently pushing forward with its own technological and regulatory development programs, principally preoccupying itself with examining whether the standards called for in the Convention are adequate, or whether more stringent standards may be necessary. In this respect much of the work currently being undertaken in the US may be viewed as falling within the scope of Coastal/Port State activities as defined in the previous section.

More particularly in relation to the Great Lakes, there are certain features which argue for special consideration. These include the uniqueness and fragility of its ecosystems as a series of effectively land-locked seas, and the fact that, because it is comprised of freshwater, it is the principal source of drinking water for many millions of people. It could therefore be argued that these circumstances justify the application of more stringent standards.

At the political level, considerable attention has been focused on the ballast water issue in Congress and the Senate.[17] The number and detailed content of the numerous Bills introduced illustrate the intensity of scrutiny that has been focused on the ballast water issue. However, it would appear that few specific performance or timing requirements have been prescribed, that would result in earlier implementation, or more stringent standards than those called for in the Convention. Without such prescription and the associated resources to achieve it, there is little political 'leverage' available to be 'harnessed' in order to accelerate current initiatives. More particularly, there does not appear to be any specific political dictate regarding what work needs to be done, nor any broad expectation as to the timing of the completion of this work

Nevertheless, significant R and D activity, directed at both shore-based testing and ship-board use, is currently being sponsored by both the USCG through its initiatives at the National Research Laboratory at Key West, and the US Maritime Administration (MARAD), in collaboration with the Northeast-Midwest Institute and others, through the Great Ships Initiative. More specifically MARAD has made a number of its ships available to its partners in this exercise, and provided not insignificant funding for R and D purposes. The pattern of the operations in which MARAD ships are engaged make them good platforms for this type of research and development, and the fact that they are frequently alongside for lengthy periods of time make them very suitable for trialing technology through a 'plug-and-play' approach. Consideration at the national level is not limited to treatment systems alone, but also includes exchange technology as well as ballast water retention possibilities. Thus final options could include a combination of treatment and exchange. The key determinant of success for the US is the performance standard achieved

In this connection, mention should also be made of the USCG STEP (Shipboard Technology Evaluation Program). This program is intended to offer an incentive to ship-owners and operators to install experimental or prototype BWT systems that have demonstrated potential for effective removal or destruction of unwanted organisms. This incentive takes the form of a

[17] Initiatives have included: S770, HR 1591 and HR 1592 all dated April 13, 2005; HR 4771 dated February 16 2006; and HR 5030 dated March 28, 2006

designation of equivalency to future discharge standard regulations, and therefore precludes the need to replace the equipment once accepted for STEP. While clearly well intentioned, it appears that the STEP program is viewed by BWT system providers and others as having a number of shortcomings which are inhibiting its appeal. These include the quite complex and time-consuming approval process for acceptance on the Program (that includes presentation of the proposal for public review and comment), the fact that it is ship (rather than system) specific, and the quite heavy commitment to a schedule of experimentation and reporting for a period of five years. While a modest number of ships (in collaboration with system providers), have been pursuing STEP acceptance, the large majority are apparently preferring to await further developments. In short, it would appear that STEP is not generating the necessary incentive to the ship-operating industry to stimulate widespread acquisition of BWT systems.

In support of the needs and expectations of the Ballast Water Convention, and recognizing that for it to be successful there needs to be wide availability of technological performance information, there is a clear understanding and expectation that virtually all the technological data emerging from the work currently being undertaken in the US will be placed on an on-line database and in this way made available on a global basis.

Despite this quite extensive developmental activity, there appears to be a broadly held view that the US is not progressing at a pace that will ensure that the requisite standards are in place in the timescale called for by the Convention, let alone achieve introduction in advance of the Convention or more stringent standards in that timescale.

In parallel with the scientific research and development currently being undertaken, the USCG has launched an important regulatory development initiative. In addition, studies into the environmental and economic impact of adopting various ballast water management standards have also been launched. The aim of these studies is ultimately directed at identifying the most appropriate discharge standards. Presently the USCG expects to offer several ‘candidate’ sets of standards, including the status quo, the Convention performance standards, and some more stringent standards yet to be fully defined.

Similar to the basic assumptions reflected in the Convention, the US sees treatment of ballast water as potentially offering the most attractive solution. Not only does treatment have certain technological attributes in comparison to exchange, including the effective removal of all organisms above a certain size (as opposed to an exponentially reducing occurrence), but it also provides the means of meeting the necessary performance standards for coastal and other non-ocean movements, where the depth requirements necessary for exchange may not be easily available at any time during the voyage.

It is recognized and accepted that, whatever the standard selected there will be interest groups that will be less than satisfied. If the selected standards fall short of total elimination, environmentalists will be unhappy, while excessively stringent requirements, involving high cost, will result in opposition from ship commercial interests in the Great Lakes that rely on shipping operations. Certainly numerous public perception issues will need to be dealt with, as well as the inevitable frustration at a number of levels with what no doubt appears to be slow progress towards a solution.

3.3 Activities in Canada

Not surprisingly there is considerable commonality between the US and Canadian approaches, although Canada’s research and development effort is on a significantly more modest scale. The

research program is being supported by funds assigned under the Oceans Action Plan, and is being led by the Central Region of the Department of Fisheries and Oceans. Other interested departments and agencies include Transport Canada, Environment Canada (particularly in relation to its Invasive Species Strategy), the Canadian Food Inspection Agency (particularly in relation to the VHS virus issue), Foreign Affairs and the Province of Ontario. Canadian initiatives are being undertaken in close collaboration with the US, principally through the Ballast Water Working Group (see below). Similar to the US the principal thrust of this research is to establish whether the performance standards set out in the Convention meet the needs of the Great Lakes, or whether more stringent measures are required.

With regard to the development of treatment technology, there has been little in the way of government initiatives, beyond support for predominantly industry-led initiatives such as Fednav Ltd.'s 'Ocean Saver' trials. In this respect it would seem clear that Canada is expecting to rely on treatment equipment that is being developed elsewhere. This situation serves to reinforce the concept of Canada as principally a Coastal/Port State in the oversight of ballast water management activities. In this capacity it can expect to face associated challenges such as possible difficulties in data availability, as well as the need to validate other Flag State certification processes.

With regard to testing, Transport Canada does not expect to undertake the testing of ballast water itself but will look to ISO certified laboratories to undertake this testing on its behalf. Nevertheless TC will clearly need to set out various test procedures, and will likely face some difficulties in defining the specifics of the tests to be conducted. For example, and recognizing the diversity of configuration of ballast water tanks, decisions will clearly need to prescribe the number of samples that must be taken, and the location from which they must be drawn, as well as what exactly constitutes a 'viable organism'. Presently, because the process in principally directed at measuring the efficiency of exchange processes, testing is directed at measures of salinity, but this relies on a correlation between salinity and survival expectations. Such an approach will likely be unworkable in the case of certain treatment systems. What is required is a 'magic meter' but as yet the technology for such an instrument does not exist.

Currently Canada's Ballast Water Regulations call for mandatory exchange procedures, but also accommodate the new Convention's treatment performance standards, at least up until 2009, and provide for the possibility of exemption from exchange if the treatment standards as reflected in the Convention are met.

Transport Canada recognizes the need to type-approve systems for use in Canadian waters, and to undertake some sort of Flag State inspection to confirm adherence of Canadian Flag ships to the Convention standards. However, this is again more problematic in relation to Port State inspections. There is presently no international requirement for annual inspections of ballast water treatment equipment, and TC does not currently have authority to undertake any such inspections. In order for Canada to have that authority under its Port State Control mandate, the Convention needs to have entered into force and Canada needs to have become a party to that Convention. Otherwise it will have no convention based authority to detain ships for ballast water treatment deficiencies. This is of concern since there is some likelihood that the major open registries will likely ratify without having the full range of equipment testing, approval and certification procedures in place.

Like the US there is an expectation among Canadian authorities that the Great Lakes will require the application of standards that are more stringent than those of the Convention, and also that imposition of more stringent standards may require a fresh start in developing the

technology capable of meeting those standards. In this respect Transport Canada supports ratification of the Convention, with the expectation that it may need to collaborate with the US on the application of more stringent standards in due course. Again the G13 Guidelines are awaited to shed more light on the feasibility of this approach. Canada would also like to require that all ballast water be treated at the point where it is taken on board, but this obligation is not included in the Convention requirements

Selective application of more stringent standards is problematic from certain other perspectives. There is some expectation that were more stringent standards to be called for in the Great Lakes, there would be demands from environmental interests for the application of similar standards elsewhere in Canadian waters, for example on the West Coast or in the Arctic. In this respect there would be a need to demonstrate why such standards were NOT required elsewhere!

A further important challenge that Canada will need to address is the situation with regard to exemptions. Because most domestic traffic does not follow routes that provide an opportunity to exchange ballast water, (for example ships sailing between Montreal and the Arctic), so it has been seen as appropriate to exempt such ships from application of the exchange requirements. Were Canada to ratify the Convention, such ships would be obligated to fit treatment equipment and such exemptions would cease. This is raising some concern among ship operators, who wish to understand what will be expected of them before ratification takes place, or whether they can qualify for new exemptions under the terms of the Convention. Some difficult discussions are anticipated at the Canadian Marine Advisory Council (CMAC), the main forum for technical discussion between industry and the Canadian government, before this issue is resolved.

Finally Canada has been examining what is required for its ports to meet the 'reception' obligations contained in the Convention. For example, some effort was recently invested in examining whether the Port of Belledune could provide such services since it had certain vacant facilities that could perhaps be adapted. Despite the availability of these facilities it was concluded that the concept was not workable. As mentioned earlier, meeting the obligation hinges upon the interpretation of 'adequate'. At present there is not seen to be any easy solution to this matter.

3.4 Bi-National Activities

The need for collaboration between the US and Canada was formally recognized through the establishment in January 2006 of a bi-national Ballast Water Working Group comprised of representatives from Transport Canada Marine Safety, the U.S. Coast Guard, the U.S. Saint Lawrence Seaway Development Corporation, and the Canadian St. Lawrence Seaway Management Corporation. Bilateral cooperation is clearly extremely important since while the environmental threat presented by ballast water brought into the lakes by ocean-going ships is of particular concern to eight US state governments (as well as two provinces), the interests associated with the operation and ownership of those ships are principally affiliated with Canada. In 2007, the BWWG is expected to continue its work to finalize plans for a bi-national data base to be used for input and data management by the four agencies, to track progress of the International Ballast Water Standard, and to compile and review end of year data on the Ballast Water Tank Exam program.[18]

[18] Extracted from http://www.greatlakes-seaway.com/en/navigation/ballast_water.html on February 17 2007

3.5 State/Provincial Activities

A significant complicating factor in the development of bi-national standards is the unilateral action that has currently been taken by certain US states to introduce legislation/regulations governing ballast water management in State waters. The state of Michigan has now passed such legislation, and Michigan Senate Bill 332, enacted into law June 2, 2005, now requires all ocean-going vessels engaging in port operations in Michigan after January 1, 2007 to obtain a permit from the Michigan Department of Environmental Quality (MDEQ). To receive a permit, the vessel must show that it will not discharge aquatic invasive species (AIS) into state waters. If a ship intends to discharge ballast water, it must demonstrate that it is using "environmentally sound technology and methods" to prevent the discharge of AIS into State waters.[19]

No other Great Lakes state has yet passed similar legislation but there are clear signs of the intention to do so in three other states, namely Indiana, Minnesota and Wisconsin. Similar initiatives have also been taken in the province of Ontario but the more clear assignment of jurisdiction in marine matters to the federal level makes it highly unlikely that any provincial law could be enacted governing the handling of ships' ballast water.

It is beyond the scope of this paper to examine the implications of these state actions. Suffice it to say here that they undoubtedly complicate, and will very likely delay, the establishment of a uniform, cohesive ballast water management regime in the Great Lakes.

3.6 Industry Activities—Equipment Producers

As will have been clear from Section 2, 'industry' comprises both equipment producers and ship-operators. Unlike ship-operators, whose livelihood depends on finding a solution to the issue, the motivation of equipment producers is driven largely by entrepreneurial opportunities. It is clear that, on a worldwide basis, considerable interest is being shown in researching possible technological solutions, an interest driven by recognition that there are some 50,000 ships in the world that will need to be fitted with such equipment. At an average of up to $1million/ship as a rough estimate, this offers quite an attractive business opportunity. However it is clear from discussions with a number of equipment providers in the US that, the STEP program notwithstanding, there is considerable frustration among equipment providers. This frustration may be attributed to their inability to move rapidly ahead with development and production of treatment equipment principally because of the continuing uncertainty associated with the standards that might ultimately be applied.

3.7 Industry Activities—Ship-Operators

Recognizing the key importance of the use of ballast water in the operation of cargo-carrying vessels, the ship-operating industry has taken a significant and proactive interest in the issue of ballast water management. Its clear position both north and south of the US/Canadian border is that it would like to see the Convention enter into force as soon as possible. However it has also understood, and is generally sympathetic to, the rationale for the application of more stringent standards, and therefore does not oppose application of such standards so long as the associated technology capable of performing to those standards is made available to them.

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[19] Stephanie Showalter, *Michigan's New Ballast Water Regime: Navigating the Treacherous Waters of States' Rights, Federal Preemption and International Commerce,* National Sea Grant Law Center, October 2006

Members of the US shipping industry have established a Ballast Water Coalition, comprising some fifteen associations, so as to provide a consistent position on ballast water treatment. An important member of this coalition is the Chamber of Shipping of America (CSA) which represents a number of US based ship operating companies. Such companies may operate both US flag and foreign flag ships. The Chamber's principal focus of interest is facilitating compliance in safety and environmental protection matters, and in crew training and competencies.

CSA is currently a member of the US delegation to IMO, and has actively participated in the development of the US position on the Ballast Water Convention. In this respect industry is provided with a quite influential voice in the policy development process.

CSA's preference would be to see an internationally consistent regime of standards governing ballast water, at least in the early years following ratification of the Convention. However if the US chooses to adopt more stringent standards, the industry can accept that situation and will do its best to comply, so long as it is provided with the means to make it work. As mentioned above, the simple but absolutely essential prerequisite is that the industry not be asked to perform to standards that are not attainable by affordable technology. Ultimately the master of a ship needs to be assured that there are no substantive restrictions on the ship's mobility due to standard differentials.

It is for this reason that the MEPC has been conducting a pre-review process to ensure that ship mobility is not hampered by a significant diversity in national standards, and that such standards are enforceable.

Four members of the CSA have been engaged in the operational testing of ballast water treatment equipment on their ships. These include a tanker on the Alaska-West Coast route, a small chemical tanker on the Great Lakes, and two vessels trading in the Gulf between Texas and Florida.

In Canada there have been similar initiatives taken by the ship operating industry. A recent initiative has been the creation of a new industry partnership entitled 'Green Marine'. This partnership consists of eight associations,[20] and a major preoccupation is ballast water management. As mentioned Fednav International, a Canadian owned company is actively involved in ballast water treatment research and development, and it is understood that Canfornav Limited, another Canadian owned shipping company is currently installing a Korean ballast water treatment system on one of its ships for trial.

Despite the ship-operating industry's strong support for development and implementation of a solution, the intense world-wide research activity and quite rapid emergence of a variety of technologies has caused ship-owners to be somewhat hesitant to invest significant funds in the latest available equipment, only to find that improved technology emerges, resulting in regulations that impose more rigorous standards than that to which the original equipment can perform. This issue is discussed more fully later.

[20] These include: The American Great Lakes Port Association, the Canadian Shipowners Association, the Chamber of Maritime Commerce, the Lake Carriers Association, the Shipping Federation of Canada, the St Lawrence Economic Development Council (SODES), the St Lawrence Ship –Operators and the United States Great Lakes Shipping Association

3.8 Summary

As made clear at the beginning of this Section, it is beyond the scope of this limited study to provide a comprehensive overview of all the activity in which the international marine transportation community, as well as US and Canadian governments and industry, have been engaged. Suffice it to say here that this activity is quite extensive but the issues being addressed are also highly complex. This is important in the context of the objective of this paper which is to shed some light on the potential for accelerating introduction of an effective ballast water regime.

Having now reviewed the process by which ballast water management is being implemented, and briefly described the nature and extent of some of the more important projects and activities currently being pursued, it is now appropriate to address some of the timing considerations associated with this implementation process.

4. HOW LONG WILL IT TAKE? SOME INSIGHTS INTO FORECAST TIMING

4.1 Introduction

Section 2 endeavours to break down the various steps in which the marine transportation sector, at all levels, is engaged as it seeks to address and resolve the ballast water management issue. Various 'streams' of activity are at play, some of them advancing concurrently, others relying on the completion of one stream before the next can commence. The aim of this section is to examine the interdependency of these streams, and to make broad assessments as to the range of potential timings for completion of each stream. In this way it is hoped to shed light in broad terms on how long it will likely take to implement an effective ballast water regime for the Great Lakes.

The linkages between these 'streams' is illustrated in Diagram 4. It may be seen that the product of the 'State Party' stream is the availability of ballast water management systems certified as meeting or exceeding the requirements of the BW Convention. This product constitutes the input to the 'Flag State' stream, thus enabling ship-owners to purchase such systems, and Flag administrations to certify them as meeting the requisite standards. It is only following the completion of this stream that the obligations of the Convention may be considered to have been effectively met.

Because the third stream, namely that identified as Coastal/Port State, effectively revisits the starting point for the Convention, by questioning whether the standards prescribed by the Convention are sufficient, the product of this stream may well result in the need to repeat the steps identified in the 'State Party' Stream, but this time to meet the more stringent standards. This outline of inter-relationships between activity streams will now be examined more fully.

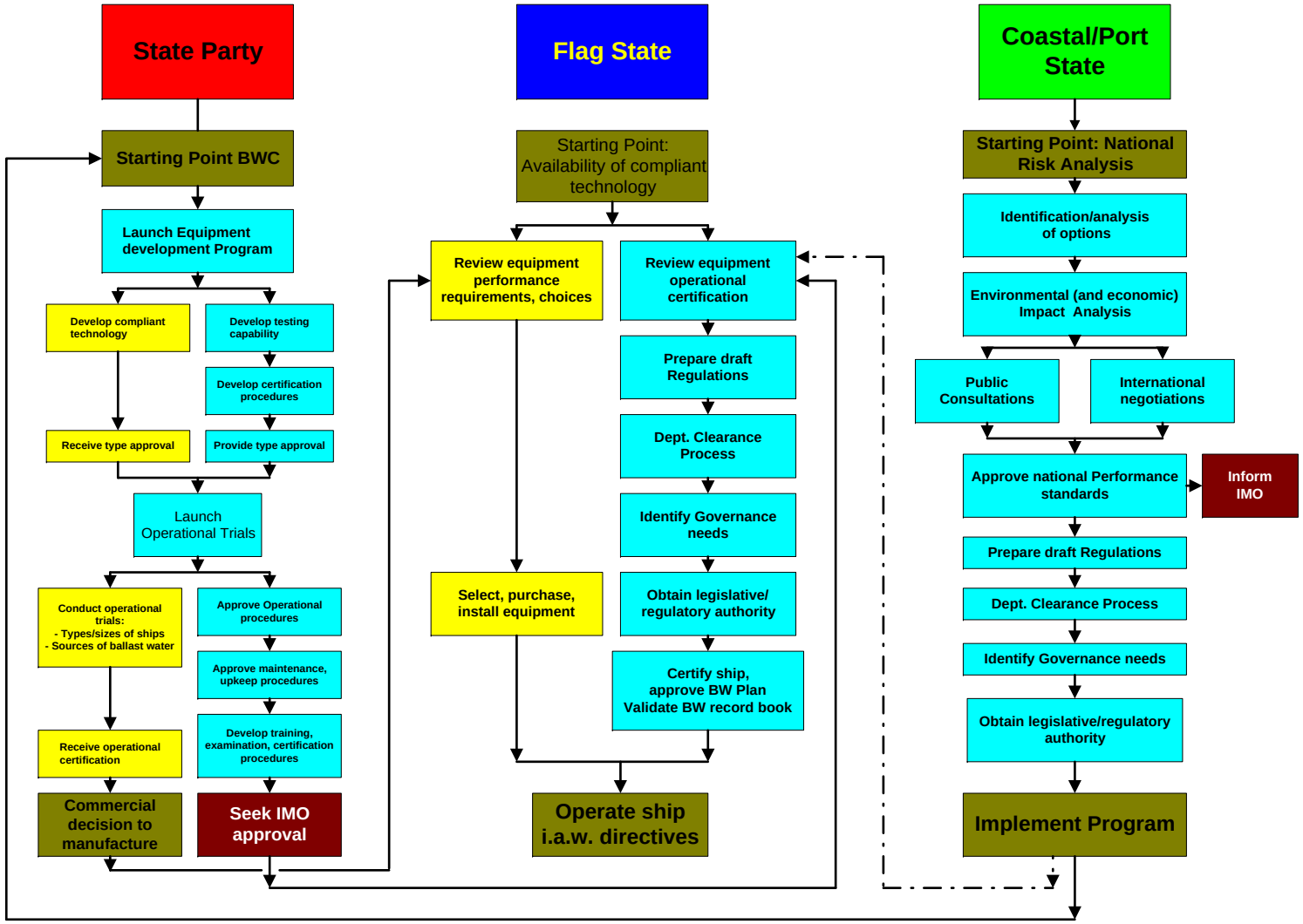

Diagram 4 Ballast water regime development process.

4.2 Timing of International Activities

As mentioned earlier, the planned timescale for implementation of the Ballast Water Convention is clear, and calls for implementation between 2009 and 2016. As also mentioned, there is now some concern being expressed in certain quarters, notably the MEPC at IMO, that the installation of properly certificated ballast water management systems on ships already contracted to be built in or after 2009 may not be feasible or only possible at excessive cost, and that some amendment to the first application date, or the provision of some form of exemption procedure may need to be introduced once the Convention is ratified. That said, there appears to be a reasonable expectation that, unless there is a major problem encountered in the timing of entry into force of the Convention, it should be possible for the management regime anticipated by the Convention to be implemented broadly in line with the approved timescale.

As explained in Section 2, a key consideration governing the timely implementation of the Convention is the development, type approval, manufacture, sale, installation and certification of ballast water management systems capable of meeting or exceeding the requisite performance standards. Progress is clearly being made in this respect, but much remains to be done. In this respect, the possibility of delay cannot be ruled out. On the other hand it is really not possible to accurately assess the likelihood or scale of any delay. For purposes of this analysis a realistic projected timing is illustrated in Diagram 5.

4.3 Timing of US Activities

Much of the work currently being undertaken in the US has been described in the previous section, and is directed principally in identifying the most appropriate ballast water standards for application in US waters, and particularly the Great Lakes

It is understood that the USCG, in collaboration with several other agencies with responsibilities in this matter (MARAD, NOAA, EPA[21], others), expects to publish an Environmental Impact Statement in the fall of 2007. This Statement will not only set out environmental considerations and concerns, but will also include an economic impact summary.

Following the release of this Statement, and in order to fulfill the obligations of the democratic process, a number of meetings will be held across the country to receive feedback from the public, to confirm the validity or otherwise of the various statement findings, and to establish what level of stringency of standards would appear to be most appropriate. This process can be expected to take at least six months.

Following this consultation phase, regulations implementing the selected standards would then be drafted, following which a quite extensive ‘clearance’ process would be required involving various offices in the USCG and the Department of Homeland Security, as well as EPA, and the Office of Management and Budget. This process could take up to a year.

It is of course an option for the US to ratify the Convention while this work proceeds. However, no decision has yet been made as to whether and if so when, such ratification might take place. The US is waiting to see how the guidelines play out, - in particular the standards for type-testing (G9) and the manner in which ‘more stringent measures’ are authorized under G13.

Recognizing all the above, and in the absence of Congressional direction calling for (and resourcing) an accelerated program, or directing some shortening or circumvention of the

[21] The US Maritime Administration, the National Oceanic and Atmospheric Administration, the US Environmental Protection Agency.

process (which would no doubt be viewed negatively), the US is unlikely to be in a position to either ratify the Convention, or to announce the application of more stringent measures, before sometime in 2009 at the earliest.

As mentioned earlier, there is significant concern at the US state level to see effective performance standards implemented, and most of the Great Lakes states are looking to the federal level to address this problem as a matter of some urgency. It would seem clear that failure at the federal level to demonstrate effective and timely progress will result in other states following Michigan's example.

This potential for the emergence of a patchwork of state regulatory regimes, and the problems such actions would create, is of significant concern to officials at the federal level who believe that the only viable way ahead is for a solution at the international or, at a minimum, national level. MARAD's Office of Environmental Activities is a focal point for addressing this concern.

Recognizing that the principal product of current research and development efforts is likely to be more stringent standards, this would then give rise to the need to develop ballast water management systems capable of achieving these standards. It could also be that the requirement for more stringent standards would be limited to the Great Lakes. This begs the question as to whether or not the international technological community would be interested in developing equipment for this limited market. If not then the major initiative for such development would likely be confined to the US (and Canada). This reduced scale of research and development effort applied to this process (in comparison to the worldwide effort currently being applied to meet the convention requirements) could possibly extend the time for the development of the necessary higher performing equipment to occur. Again, whether or not the development of the necessary equipment was to take place in N. America, the sale of such equipment, at least for ocean-going vessels trading into the Great Lakes, would likely need to be to ship-owners who are operating ships registered in other, probably open registry, States.

All of which leads to the conclusion that, should more stringent standards be prescribed, it may well be 2012 before the first ships, equipped and certified to meet or exceed these standards, are operating into the Great Lakes,. In this respect, it should be noted that there is an important relationship between the timing of introduction and the performance standards required. Assuming the US chooses not to ratify the Convention, the application of more stringent standards could well have the effect of delaying the implementation of any treatment standards, let alone those called for in the Convention.

4.4 Timing of Activities in Canada

A clear assumption in relation to the Great Lakes is that whichever State (US or Canada) chooses to apply the most stringent standards the other State is likely to feel obliged to align itself with that standard. In this respect, it is not unreasonable to expect that the intensity of interest being demonstrated by the eight US states is likely to result in the US adopting more stringent measures than called for by the Convention. Canada would expect, therefore, to adopt the same measures.

As mentioned earlier however, Canada's current position appears to be that on balance it supports ratification of the Convention, despite some complexities that it presents. Thus while Canada continues to conduct scientific studies, largely in collaboration with other US interests, the expectation is that Canada may well choose to ratify at the appropriate moment, and then

work with the US to apply more stringent standards as and where there is a joint national interest and involvement, notably the Great Lakes. As pointed out earlier, this strategy could give rise to difficulty since it would result in ships being required to invest in equipment to meet a certain standard only to find that that standard is insufficient if as and when Canada adopts more stringent standards

In any event it should be noted that, while still complex, the procedural consultation and regulatory phases are unlikely to involve quite such an extended program as that anticipated for the US. In this respect it would appear that it will be the rate of progress in the US that will dictate the timing of application of more stringent measures should that choice be made. It may be concluded therefore that, from the perspectives of both stringency of standards and timing of the introduction of those standards, the critical path will be dictated by US progress.

5. CAN WE SPEED IT UP? THE POTENTIAL FOR ACCELERATION

5.1 Considerations Impacting on Acceleration

As discussed in the previous section, Diagram 6 indicates that, where more stringent standards are applied, the most likely scenario suggests that it will be early 2012 before ships fitted with equipment capable of meeting those standards are operating into the Great Lakes. For consideration here is the degree to which this 'critical path' offers any potential for acceleration. The critical path is dictated first by the fulfillment of what is termed here the 'Coastal/Port State' activity stream. This is essentially under the exclusive control of government and as indicated earlier could well take at least three years. Of course, should the product of this exercise be to confirm the acceptability of the convention standards, it may well be possible to 'jump aboard' the Convention implementation 'train', without too much loss of time. If, however the result is the declared need to apply more stringent standards, there is a risk of a considerable time delay while the 'State Party' and 'Flag state' activity streams are repeated for the new standards.

There are two points that should be noted in relation to the speed with which the State Party and Flag State activity streams might be accomplished, and therefore its potential for acceleration. The first is that again the large majority of the various activities along the critical path are principally controlled by government. While there is important industry involvement, such activities in which industry is engaged are in parallel with related government activities and have little direct influence over the speed of advance of the process. In this respect the primary influence over that advance rests with politicians and public sector officials, and any decision to accelerate progress is ultimately at the direct discretion of the government.

Secondly, it is largely self-evident to operators of ocean-going ships that they will only be tolerated if, as and when their ships meet the requisite standards. In this respect, and as supported by interviews with shipping associations, such operators are clearly highly motivated to find a solution and need little in the way of further encouragement to collaborate in the search for a solution. Again as supported by interviews, equipment manufacturers are also very much aware that they have a large, ready, and virtually captive market for their products and are very attracted by the entrepreneurial opportunities that this situation presents. Both groups are, however, clearly dependant on governments to orchestrate the circumstances that enable them to act upon this motivation.

Convention Implementation	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
'State Party' Stream											
'Flag State' Stream											

Diagram 5 - Forecast Timing - Convention Implementation

More Stringent Standards	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
'											
Coastal/Port Stream											
State Party' Stream											
'Flag State' Stream											

Diagram 6 - Forecast Timing - Implementation of more stringent Standards

In this respect there are several further considerations that are most likely to influence the speed of advance. These include, for example, recognition that any decision to retain the option of applying standards that are more demanding than those included in the Convention, will negatively impact the implementation timing. This is not to suggest that this is necessarily wrong, but to note that there are negative consequences associated with such a course of action.

Secondly, accommodating all the normal exigencies of the democratic process also results in an extended program of activities, particularly if the possibility of standards being applied that are beyond those reflected in the Convention is open for consideration. To curtail these processes might be viewed as undermining this democratic process; however, if the need for some action is both clear and urgent then it may also be argued that environmental protection delayed is environmental protection denied.

Ultimately it would seem that decision-makers are faced with a trade-off: either one strives for the highest performance standards and accepts delays in getting there, or one settles on a lower (but perhaps still acceptable) standard, but gets it in place much faster.

6. CAN 'CARROTS' OR 'STICKS' HELP? THE POSSIBLE ROLE AND CONTRIBUTION OF INCENTIVES OR DIRECTIVES TO FACILITATE ACCELERATION

6.1 Introduction

Some preliminary insights into the involvement of industry in advancing the implementation of a Great Lakes ballast water system were provided in Section 5. This Section will take a closer look at the role of industry and the possible contribution of incentives.

In addressing the question as to whether 'carrots and 'sticks' might be able to play a role in accelerating the implementation of an appropriate ballast water management regime, there is first a need to note and appreciate certain important considerations. First it should be recognized that 'carrots' and 'sticks' are both forms of incentive, the former designed to make it attractive to achieve particular goals, the latter designed to discourage non-achievement of those goals. Normally it is government that provides such incentives, and it is industry that is the recipient. Recognizing that the purpose of incentives is to influence behaviour, then at issue is whether some form of behavioural change would result in achievement of particular goals, in this case an acceleration of the process. More particularly, before examining what 'carrots' or sticks' might be utilized, there is a need to examine the degree to which industry behaviour has the potential to influence the speed of implementation of a specified ballast water management regime.

Secondly recognizing that the target of any incentives is industry, whether it be equipment manufacturers or ocean-going ship-operators, it may be expected that large elements of both industry sectors will be located abroad, since the ballast water treatment initiative is being pursued on a worldwide basis, and almost all of the deep-sea vessels trading into the Great lakes will be of foreign registry. Thus any consideration of the role that incentives might play needs to take into account this important characteristic.

6.2 Performance Incentives

It should be noted that the principal focus here is on incentives directed at achieving acceleration. This is different from incentives directed at encouraging improved performance. Because it is important that this difference be fully understood, a few observations will be offered here on performance incentives.

It is suggested that incentives directed at influencing environmental performance are usually applied under the following conditions:

- The performance standard in question relates to an ongoing operating characteristic of a ship (for example, main engine exhaust gas emissions);
- There is an upper mandatory performance standard, below which there is a range of acceptable performance;
- While the upper end of that range fixes the limit of acceptability, it is seen as desirable to encourage performance to more demanding standards;
- There is a means to measure, quickly and accurately, actual performance, and hence establish the level of achievement of improved performance within the acceptable range;
- There is a means of providing benefits ('carrots') to ships that achieve these more attractive standards, through a graduated scale of reduced rates, charges, tolls, etc., or through preferred treatment allowing ship operators increased efficiency, or equivalent incentives.

Recognizing that there is a mandatory upper limit, there will generally need to be some form of penalty ('stick') that discourages ships from ignoring that limit. This could take the form of fines, detention or other legal action. Of course an essential prerequisite for the application of such a 'stick' is a competent enforcement authority

In any debate on ballast water performance management, there has been little talk of a range of acceptable performance standards. However, in the absence of such a range there is little scope for applying incentives in the form of differentiated fees to encourage achievement of the highest standard. Instead the approach adopted in the Convention, and anticipated in N. America, is to define a single mandatory performance standard which all ships must meet or exceed

Several other features in relation to ballast water influence the feasibility of the application of incentives to performance management. For example, ballast water handling is not an ongoing operating condition (such as running the main engine), but is a procedure conducted from time to time. Thus there is no risk of environmental degradation except when that procedure is being executed, (either to take on, exchange, treat or discharge ballast) and only then if it is either conducted improperly, or the equipment being used in the procedure is not performing to acceptable standards.

In the case of emission standards resulting from the use of a ship's main engines, if the ship is under way, the main engines are in operation, and certain exhaust gas emissions are being discharged. The aim is not, then, to eliminate such discharges, a target which may be technologically impossible, but to introduce incentives to reduce the nature and extent of the environmentally damaging elements in the emissions. This may be done through differentiated fees, an approach currently being used in Sweden. However, such characteristics, and therefore remedies, are not evident in relation to ballast water.

Again, in relation to enforcement, and taking the discharge of oily waste liquids as an example, States party to MARPOL are required to ensure that oily bilge-water is only discharged below a certain limit of concentration.[22] If a ship exceeds that amount it is guilty of an offence and may be fined. The level of the fine would be decided based on the severity of the pollution that was caused. However, unlike air emissions, there is no potential for the application of incentives such as differentiated fees.

Ballast water falls into a category similar to the discharge of oily waste. However, unlike the discharge of oily waste, the immediate evidence of contaminated BW discharge is usually very difficult to detect, and the time interval between actual discharge and the disclosure of ecosystem damage from alien species is likely to be so long as to render it extremely difficult to link the introduction of an alien species to any particular ship. In this respect, unlike illegal discharges of oily waste, where detection techniques can be quite effective in linking the discharge to a particular ship, the ballast water discharge monitoring and enforcement function presents significant challenges, to the point where effective enforcement may prove to be impossible, and the only realistic choice is to pursue a policy of ensuring compliance with ballast water treatment procedures prior to any need to discharge ballast water

Another issue relates to the provision of shore-based reception and treatment facilities. The MARPOL Convention obligates States Party to provide such facilities. It has been recognized that use of such reception facilities can be increased by ensuring that there is no additional fee for their use.[23] However, if there is to be no additional fee, then the costs of the provision of such facilities has to be absorbed by other port charges. This introduces problems because a responsible port may take this route only to find that ports with which it competes have not even bothered to provide reception facilities, let alone provide them at no extra cost. This same consideration effectively applies to the provision of ballast water reception facilities, where the BW Convention calls for the provision of 'adequate' facilities, but the exact formula for their provision remains illusive

Of course in relation to ballast water one could theoretically envisage a situation where the Convention limits constituted the upper limit of acceptability for entry into the Great Lakes, while a more stringent standard was regarded as more desirable. In this case it could be arranged for vessels capable of treating ballast water to higher standards to be provided with some tariff benefits over vessels who could only reach the Convention standard. While this approach weakens any initiative to achieve higher performance standards, it may if constructed appropriately have some contribution to make in the context of acceleration incentives and will be discussed later.

6.3 Acceleration Incentives

Acceleration incentives differ from performance incentives in that they are directed at making things happen more quickly, rather than to a higher standard. The focus in this instance, therefore, is on the process described in Section 2, the timing considerations related to that process outlined in Section 4, and the potential for acceleration discussed in section 5.

The clear message that emerges from this material is that it is government, not industry (whether equipment producers or ship-operators), that controls the need for, and the content of, activities to be conducted in the development and implementation of a ballast water management

[22] MARPOL 73/78 sets out detailed standards and strict conditions for the discharge of wastes and residues at sea
[23] See the Helsinki Commission's Baltic Strategy

system, the amount of time to be assigned to those activities, and finally the potential for acceleration of the process. This is principally because any decision as to what standards will apply, (be they convention standards or something more stringent), ultimately rests with government, and with or without incentives, industry is constrained from moving ahead until some decision is taken regarding those standards. Again, as may be seen from Diagram 4, out of nearly 30 activities, only 6 involve industry, and all of these industry activities are largely undertaken in parallel with related government activities. One is therefore obliged to conclude that the potential for acceleration of the process through the provision of incentives, to an already quite highly motivated industry, is limited at best.

Discussions with officials in both the US and Canada suggest that the present preoccupation of both governments is to pursue the steps broadly set out in Section 2 in order to achieve an acceptable final ballast water management regime. Although the collaboration of industry in the development process is clearly valued and appreciated, there is no apparent recognition of any direct dependence on industry to advance any stage of this process, and therefore on any need to influence industry behaviour through the provision of incentives.

Most of the preceding material has been focused on either the timing of implementation of the convention standards through entry into force of the Convention, or the timing of implementation of more stringent standards. A further, at least theoretical option in relation to acceleration is whether the convention standards could be implemented in advance of the entry into force of the Convention. This would mean that ships would be encouraged to install and operate equipment meeting the standards called for in the Convention in advance of the prescribed guidelines. Certainly, in theory at least, 'carrots' in the form of differentiated charges could be offered to ship-operators to fit available technology.[24]

There are however a number of practical difficulties. If there is some expectation that more stringent standards may subsequently be prescribed, or unless some form of 'grandfather' provision is offered to ship-operators conforming to this approach, they may be expected to be extremely reluctant to make investments in what would undoubtedly be viewed as 'interim' technology, for fear that very soon they would be required to replace it with more advanced, higher performing equipment. Again for governments to construct incentives based on the Convention standards might be viewed as sending signals of intent to ratify the Convention, thus making the subsequent adoption of more stringent standards that much more difficult.

There is also the question of how the differentiated fees might be funded. Certainly the service providers whose fees would be adjusted would not be willing, indeed able, to swallow the cost of such a strategy.

Again, such an approach could be achieved through regulatory enforcement. While a State may be strongly criticized by the international community for damaging the concept of a single cohesive international regulatory regime for marine transportation, any sovereign State could apply such legislation/regulations governing the operation of ships in its internal waters as it sees fit, including ballast water management standards. This would, however, be a more radical and complicated option than the application of differentiated fees, since it would significantly curtail the element of choice. It would also likely be counter-productive since, in a situation where there is only limited availability of well-proven treatment equipment certified to the necessary standards, ship-operators would very likely feel compelled to take their business

[24] This would be not dissimilar to the Swedish Maritime Administration's introduction of differentiated fees in relation to air emissions, which was introduced in advance of the entry into force of MARPOL Annex VI.

elsewhere. This would appear to be the emerging situation in response to the State of Michigan's recent legislation.

Liability has also been suggested as a potential incentive mechanism. For consideration, also, is whether the risk associated with introduction of alien species, and the associated liability could somehow be mobilized to encourage ship-operators to equip their ships with the necessary treatment equipment in advance of any prescribed timescale. As mentioned earlier, the difficulties of detection coupled with the time lag before introduction of an alien species is established, make the assignment of liability extremely difficult. Nothing of course prevents any interest group public or private from initiating legal action, this is unknown territory and not possible to predict with any accuracy. The situation is rendered more complicated when a ship that may be held responsible for ballast water contamination has been inspected and approved to conduct BW operations by government authorities

It has been further suggested that shippers who rely on ocean-going ships to move their goods could somehow bring their influence to bear to persuade ship-operators to move more quickly to adopt ballast water treatment equipment. This presupposes that shippers are likely to be more environmentally conscious and motivated to find a solution than ship-operators; however there is very little to support this presupposition. It also presupposes that it is totally within the range of choice of ship-operators to adapt to new operating standards, without recognizing that neither the finally prescribed standards nor the equipment designed to meet those standards is currently available.

The possibility has also been raised as to whether some of the incentive concepts applied to road transport, such as the Corporate Average Fuel Economy (CAFÉ) program or the High Occupancy Vehicle (HOV) program might have parallel concepts for application in the marine transportation field. Again this presupposes an ongoing situation where there is a range of acceptable behaviour, and where incentives are used to make it more attractive to move to the most environmentally beneficial end of the range. It is difficult to envisage an equivalent situation in relation to ballast water management where only effective elimination is acceptable.

In short, the nature of the development process with its high level of government control, coupled with the already high motivation of the ship-operating industry, suggests that the scope for accelerating the ballast water management process through the use of 'carrots' and 'sticks' is comparatively limited.

6.4 Shipping Policy Initiatives

There is perhaps a final point relating to N. American shipping policy that merits mention here. The ballast water debate raises some interesting questions regarding national shipping policy that is relevant in both the US and Canada. A clear complication in the evolution of an effective ballast water regime for the Great Lakes is that those ocean-going vessels that trade into the Lakes are, almost without exception, foreign flag, even if many may be owned by US or Canadian interests. Because it is the Flag State that is principally responsible for ensuring that its ships are certified to meet such ballast water performance standards as it has prescribed, these functions are outside the direct control and influence of the US or Canada, which only has authority to regulate in its capacity as a port or coastal State. Thus the availability of ships suitable for operating into the Great Lakes and the timing associated with that availability, may only coincidentally meet the needs of US and Canadian shippers.

There is almost certainly no miracle solution to this issue that could transform the situation overnight, but significant lessons could be learnt from Europe where EU member countries have provided policy and taxation regimes that in many cases have served to stimulate expansion of their national flag fleets in the face of open registry options. This has been achieved by treating international marine transportation as a unique market demanding unique solutions including favourable (tonnage based) tax regimes and income tax relief for national seafarers serving in international trade. Such an approach has not excluded open registry by any means, but it has allowed EU nations to maintain a presence and in this way provide a degree of economic and environmental security. This trend has received attention in the US in the past, most notably in 2001 when Congressman Oberstar introduced a draft Bill entitled *HR3262 – The Merchant Marine Cost Parity Act.* While this Bill was overtaken by 9/11 and has not yet been reintroduced, it demonstrates that some earlier thought had been given to this possibility.

It is well beyond the scope of this paper to explore this possibility further, but it could well merit some attention, as a means of providing more direct control and environmental security of ocean-going ships trading into the Great Lakes.

7. WHAT DO WE LEARN FROM ALL THIS? SUMMARY AND CONCLUSIONS

The ultimate aim of this study has been to explore whether there are opportunities to accelerate the development and adoption of ballast water technologies for vessels operating on the Great Lakes,. More particularly its purpose is to identify and evaluate (briefly) various economic, political, legal or regulatory 'carrots' or 'sticks' that might be used to hasten the development and adoption of ballast water treatment technologies.

The broad conclusion of this work is that such opportunities are limited at best. This conclusion is based on the following products of this analysis.

- The timing of the implementation process is largely dictated by the availability of treatment equipment that either meets or exceeds the requisite ballast water management standards. However, in the absence or prescribed standards for the Great Lakes, development and production of the necessary technology is significantly inhibited. This situation is exacerbated by the broad expectation in Canada and the US, particularly among government bodies with a role in the final selection of standards, that the standards called for in Ballast Water Convention are unlikely to be regarded as sufficiently stringent to meet the needs of the Great Lakes. Thus there is little rationale for the provision of incentives to develop and produce treatment equipment, until or unless the performance expectations are fixed. Put another more blunt way, the best means of advancing implementation is to approve the necessary standards, so that industry can get on with the job of meeting them.
- What we are examining here are acceleration incentives. Thus the premise is that were industry to do something more quickly than it is currently doing, overall implementation would be accelerated. However, as made clear in Section 5, industry's role and influence in the overall implementation process are really quite modest and such activities in which industry might be engaged are in parallel with related government actions. In this respect the premise would not appear to be valid. It is clear that industry is ready and highly motivated to move rapidly ahead to a point where the incremental gain in motivation from incentives would likely

be marginal at best. What industry (whether it be equipment providers or ship-operators) needs much more than incentives is the standards!

- Possible incentive options that have been offered for examination include seaway tolls, pilotage dues or port dues. Firstly, it should be appreciated that under almost all scenarios, these are performance incentives, not acceleration incentives. Indeed, if the incentive is directed at encouraging ships to acquire high performing equipment that may involve an extended research and development program, the provision of performance incentives could actually work against the goal of acceleration.
- It has been suggested that some threat of legal action could provide an appropriate 'stick', but again, under most scenarios, this is a performance incentive rather than an acceleration incentive. Furthermore, as made clear in the previous section, there are significant challenges with tracing the introduction of a particular alien species to a specific ship, and in any event raises important questions about assignment of liability if a ship's ballast water has been tested by authorities on entry to the Great Lakes, and received a seal of approval.
- Again, as pointed out in the previous section, the concept of incentives carries with it the idea that there is a range of performance that will be tolerated, and that the incentives are directed at encouraging a shift to the most desirable end of that range. They do not however preclude operation at the least desirable end of the range. If this concept is applied to acceleration, then it suggests that ships may ultimately choose to ignore the incentive, and only achieve compliance when standards are obligatory. This in turn suggests that, while undesirable, the scenario where ships choose not to take advantage of an incentive must still be acceptable. In this respect the concept of incentives does not work well in the context of ballast water management.

In the light of all the above, it must be concluded that there is limited potential for acceleration of the adoption of a ballast water management regime for the Great Lakes through the application of incentives. This raises the question as to whether there is still potential for acceleration of implementation through means other than 'carrots' or 'sticks'.

As already made clear the principal influence over the process, and indeed the timing of that process, rests with government. Probably the single most influential acceleration initiative would be to adopt the Convention standards. Through this approach the implementation timing would likely be significantly shortened. While the option of applying the convention standards in advance of entry into force of the Convention is theoretically an option, the timing issues associated with the development, manufacture and certification of the necessary equipment almost certainly makes this option impractical. Of course, adoption of the convention standards would create serious problems for shipowners if there was some expectation that more stringent standards were to be applied sometime in the not-too-distant future. In this respect it would be difficult to adopt the Convention standards as an interim measure.

Alternatively, governments could decide to direct that acceleration be made to happen! This would mean that, instead of allowing the natural evolution of the environmental assessment process to run its course, governments would prescribe how each step in the process was to be conducted, and how long each step was to take. Governments would also need to provide the resources necessary to achieve the accelerated process. While this may appear to challenge the full application of the democratic process, it could also be argued as mentioned earlier that environmental protection delayed is environmental protection denied.

Finally it might be observed that emerging from this analysis are some interesting issues. More particularly it would appear that the seemingly (at least in the first instance) laudable efforts of the US (and Canada) to seek out and impose a more demanding BW management regime, may in fact be tending to compromise the process of development of the means by which that management regime is to be achieved. This is because the additional time and complexity involved in identifying both the degree of stringency and the feasibility of achievement of these more stringent standards are hindering the process of developing the associated technology to respond to them.

Meanwhile other international interests (for example in Sweden, Korea and Japan) are clearly moving, with apparently some modest success, to develop and implement the framework necessary to achieve the less demanding IMO Convention standards, and may well soon be able to tap international ship-operator markets. This will almost certainly be in advance of US (or Canadian) BW system manufacturers, whose development program is being hampered by the absence of the standards of performance for their primary (domestic) market against which their equipment needs to perform.

Furthermore, it may reasonably be expected that, with the cash flow generated by sales of systems that meet the IMO Convention standards, international equipment providers will no doubt then be well positioned to reinvest in further technological development to achieve higher standards, -even those that will presumably eventually emerge here! This opportunity may well not be open to N. American system providers (at least to the same degree) because they cannot presently sell effectively and on a sufficiently large scale to their primary market, (N. American ship-operators). This, in turn, is because the latter is unable to establish with any certainty the standards that the equipment that they purchase must meet in order for them to continue to operate in N. American waters!

In other words, the initial appeal of moving directly to very stringent standards, may in fact turn out to be less attractive a solution than a ‘step’ process, involving rapid adoption of the IMO Convention standards, coupled with an incentive package to encourage ship-operators to strive for higher BWT performance, together with some form of ‘grandfathering’ of the purchase of the best performing equipment in the early going (along the lines of the STEP program, only with less impediments). More stringent standards can then be applied as and when the need for them is clearly confirmed, and the technology and test procedures developed. Certainly there are important challenges with this approach; however, recognizing the important shortcomings with the present approach, the concept merits some serious consideration.

In summary (and the STEP program notwithstanding) N. American industry interests presently appear to be stymied by a lack of government direction as to what is expected of them. In such circumstances incentives have little application, until or unless government has stipulated the result that the incentives are intended to achieve, namely the treatment standards that are to be applied. Some approach that circumnavigates this problem needs to be identified and adopted. An approach as set out in the previous paragraphs may offer a way around this difficulty.

Ballast water management in the waters of the Great Lakes is a critically important environmental and commercial issue. The principal need, and top priority, is for the governments of Canada and the US to specify, as a matter of urgency, the standards to be applied and the implementation schedule they wish to see adopted in the Great Lakes, and to provide the necessary resources to make it happen.

REFERENCES

Fairplay, November 2, 2006, Solutions and New Buildings Magazine, '*MEPC makes progress'*.

Government of Canada, March 2005, Canada Shipping Act Regulatory Development Project, Public Consultation Document, *Ballast Water Control and Management Regulations*

International Maritime Organization, 13 February, 2004, *International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004*

International Maritime Organization, 22 July 2005, Resolution: MEPC.123(53) *Guidelines for Ballast Water Management Equivalent Compliance (G3)*

International Maritime Organization, 22, July 2005, Resolution: MEPC.127(53) *Guidelines for Ballast Water Management and Development of Ballast Water Management Plans (G4)*

International Maritime Organization, 22, July 2005, Resolution: MEPC.123(53) *Guidelines for Approval of Ballast Water Management Systems (G8)*

International Maritime Organization, 22, July 2005, Resolution: MEPC.126(53) *Procedure for Approval of Ballast Water Management Systems that make use of Active Substances (G9)*

International Maritime Organization, 9-13 October, 2006, MEPC 55, *Record of the Meeting*

Metcalfe, Kathy, June 22, 2004, PPT presentation: *Industry perspectives on the current status of Ballast Water Treatment*

Showalter, Stephanie, October 2006, *Michigan's New Ballast Water Regime: Navigating the Treacherous Waters of States' Rights, Federal Preemption and International Commerce*, National Sea Grant Law Center

Transport Canada, 28, June, 2006 *TP 13617E, A Guide to Canada's Ballast Water Control and Management Regulations* (Revised)

Annex 1—Task Description

Committee on the St. Lawrence Seaway: Options to Eliminate Introduction of Nonindigenous Species into the Great Lakes, Phase 2

Work Statement for Commissioned Paper
Carrots and Sticks: Opportunities to Accelerate the Development and Adoption of Ballast Water Treatment Technologies for Vessels Operating into the Great Lakes

Many in both the United States and Canada view ballast water treatment technologies[25] as the most promising option for preventing further introductions into the Great Lakes of nonindigenous aquatic species carried in ships' ballast water. Nonetheless, questions remain about when such technologies are likely to provide an effective solution to the invasive species problem. To be effective in practice, a technological solution requires:

- Proven ballast water treatment systems that function safely under a range of climatic and operational conditions, effectively eliminate a wide range of organisms at various stages in their life cycle, and have no adverse effects on the environment; and
- Mandatory use of such technologies by vessels operating into the Great Lakes.

The IMO Convention for the Control and Management of Ships' Ballast Water and Sediment establishes a timeline for the implementation of ballast water management for existing and new ships (those built before and after 2009, respectively), with a moderating provision for those built between 2009 and 2012. The implementation schedule is broken down further based on a vessel's ballast water capacity. By 2016, all vessels will be required to meet the IMO ballast water performance standard, defined in terms of numbers of organisms of given sizes per unit volume in discharged ballast water.

Ships are relatively long-lived capital goods owing, in part, to their great cost. It is routine for ships to remain in service for at least two decades, and in some instances for them to remain part of the fleet for even longer periods. Some ballast water treatment systems may be retrofitted on existing ships, although opportunities to optimize the design of such systems are far more constrained than in the case of systems for new vessels. Other treatment systems and options, such as revised ballast tank designs to facilitate ballast water exchange, will, in all likelihood, only be incorporated in new vessels.

Given the anticipated high capital costs of shipboard ballast water treatment systems, owners may have little incentive to equip new vessels or retrofit existing vessels with such systems in advance of the dates defined in the IMO convention.[26] Thus, initial orders for treatment systems may be slow in coming, making learning curve and volume cost reduction effects difficult to attain.

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[25] Technologies could include not only shipboard ballast water treatment technologies, but also systems where ballast water is pumped ashore for treatment, as well as changes in the design of ballast tanks and associated plumbing in new vessels for more effective ballast water exchange and minimization of untreated water and sediment.

[26] The IMO convention has yet to be formally signed by any of the world's leading maritime nations, much less the thirty nations representing at least 35 percent of world merchant shipping tonnage required for ratification.

The purpose of this paper is to identify and evaluate briefly various economic, political, legal, and regulatory "carrots and sticks" that might be used to hasten the development and adoption of ballast water treatment technologies for vessels operating into the Great Lakes.[27] The intent is not to explore each option in depth, but rather to identify from both the public and private sectors in Canada and the United States who (which organizations or groups) would take what actions and who (which organizations or groups) would be affected and how. Comments about the feasibility of the option and major obstacles to its implementation will assist the committee in assessing possible solutions to the invasive species / trade problem in the Great Lakes.

Options addressed in the paper may include, but should not be limited to, the following preliminary ideas identified by the committee during the course of its discussions. Some of the options may already be under consideration or underway to some degree, and the paper should summarize the current status of such initiatives.

SEAWAY TOLLS, PILOTAGE DUES, AND PORT DUES

Could financial incentives to encourage more rapid adoption of ballast water treatment technologies be provided by imposing tariffs on the ocean shipping trade into the Great Lakes? For example, vessels that voluntarily install acceptable shipboard treatment systems in advance of mandated deadlines would receive a competitive cost benefit over vessels without such systems during the intervening period leading up to the deadline. What are the politics and economics for setting such tariffs? How attractive could such inducements be made, given the economics of transportation and the availability of alternative modes of transportation in the Great Lakes region?

STRICTER BALLAST WATER STANDARDS

Could regulatory measures be taken to require ships entering the Great Lakes St. Lawrence Seaway system to treat ballast water to a higher standard than that demanded by the IMO Convention for the Control and Management of Ships' Ballast Water and Sediment?

Vessels with shipboard ballast water treatment systems capable of treatment to a higher standard would be permitted to operate into the Great Lakes, but vessels without such systems would be subjected to an alternative method of treatment, presumably shore based. Do existing institutional mechanisms permit such action? Presumably if either the United States or Canada set such a standard, the other would have to comply. But, would either do so without a joint Canada / United States agreement? Would declaration of a higher standard based on the unique freshwater character and scale of the Great Lakes provide an incentive to improve and/or accelerate achievement of a higher standard worldwide, or simply impact negatively on the trade, encouraging the use of alternative routes?

Would requiring a higher standard provide a forcing function for developing better methods of monitoring compliance?

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[27] The technical challenges of developing effective ballast water treatment systems will be addressed in a separate paper.

LIABILITY AND INSURANCE

Who bears the liability risk for ships transiting the GL/SLS system, what risks are left uncovered, and could differential insurance rates be assessed on a full-risk basis to discriminate between vessels at high risk of introducing nonindigenous aquatic species and those employing modern technologies that reduce this risk? Would such differential insurance rates need to be accompanied by strengthened legal remedies for losses incurred and means for assigning liability? How might the problem of lags between infestation and first detection of invasive species be addressed in assigning liabilities?

PUBLIC POLICY

Many governments, including those of both the U.S. and Canada, have policies to promote shipping under their own flag for both national security and economic reasons. If current U.S. and Canadian restrictions on construction / import of vessels built in foreign shipyards were lifted for vessels equipped with shipboard ballast water treatment systems, would this action increase the rate of implementation of ballast water treatment systems on vessels operating into the Great Lakes?