

Nr. 117

INTERNATIONAL NAVIGATION  
ASSOCIATION



ASSOCIATION INTERNATIONALE  
DE NAVIGATION

## Technical and Economic Problems of Channel Icing



InCom  
Report of WG 23  
2004

INTERNATIONAL NAVIGATION ASSOCIATION

- 1. Introduction**
  - 1.1 General
  - 1.2 Terms Of Reference
  - 1.3 Contents Of The Study
- 2. Different Ice Forms**
  - 2.1 Surface Sheet lee
  - 2.2 Brash lee
  - 2.3 Frazil lee
  - 2.4 Pack lee
- 3. Ice Formation And The Development Of Inland Waterways**
  - 3.1 General
  - 3.2 Influence Of Navigation On lee Formation
  - 3.3 Heat Loss Through lee Sheet
- 4. Inland Waterways**
  - 4.1 Europe

- 4.2 North America
- 5. Ice Problems On Inland Waterways**
- 5.1 Northern Europe
- 5.2 Western Europe
- 5.3 North America
- 6. Management Of Winter Navigation**
- 6.1 Northern Europe
- 6.2 Western Europe
- 6.3 North America
- 7. Icebreaking Technologies**
- 7.1 Conventional Icebreakers
- 7.2 Icebreaking Bows
- 7.3 Multipurpose Vessels
- 7.4 Double Acting Ships (Das)
- 7.5 Ice-shredder
- 8. Information And Operation Systems**
- 8.1 Northern Europe
- 8.2 Western Europe
- 8.3 North America
- 9. Winter Operation Of Inland Waterways And Navigation Structures**
- 9.1 Northern Europe
- 9.2 Western Europe
- 9.3 North America
- 10. Possible New Solutions**
- 10.1 Experiences And Experiments
- 10.2 Possible Solutions
- 11. New And Reconstructed Waterways In Terms Of Winter Navigation**
- 11.1 Lakes
- 11.2 Navigable Rivers
- 11.3 Canals
- 11.4 Locks
- 12. Costs And Benefits**
- 13. Conclusions And Recommendations**