

Current Developments in Design and Assessment of Ice Loads on Arctic Ships and Structures

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Mari-Tech, 2009 – St. John's
Northern Challenges



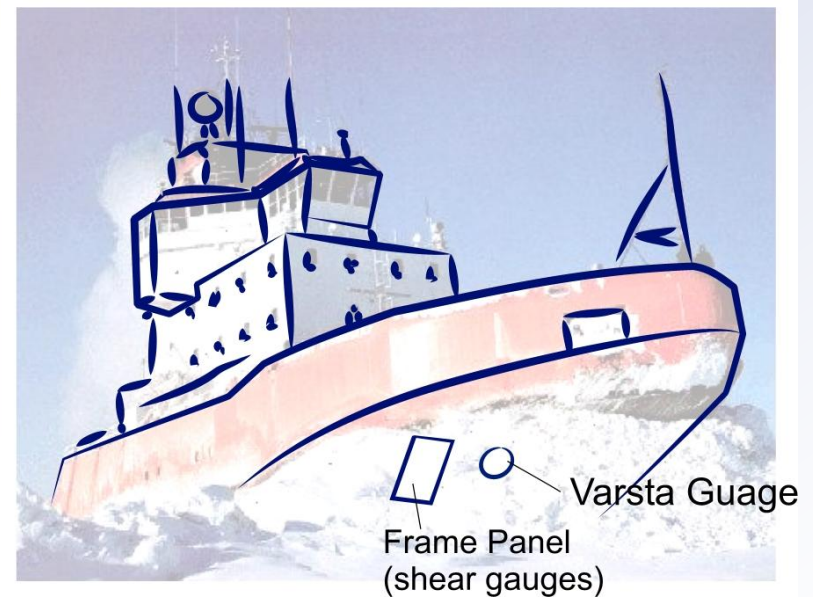
Introduction

- The Arctic remains an awesome challenge
- Structural Design is Changing – demands for enhanced safety combined with new analysis tools and better loads data is letting us do much more detailed failure analysis and design.
- Ice loads are complex, which makes measuring them difficult, and designing for them a challenge.
- This presentation describes some recent work on ice loads and ice-worthy design.

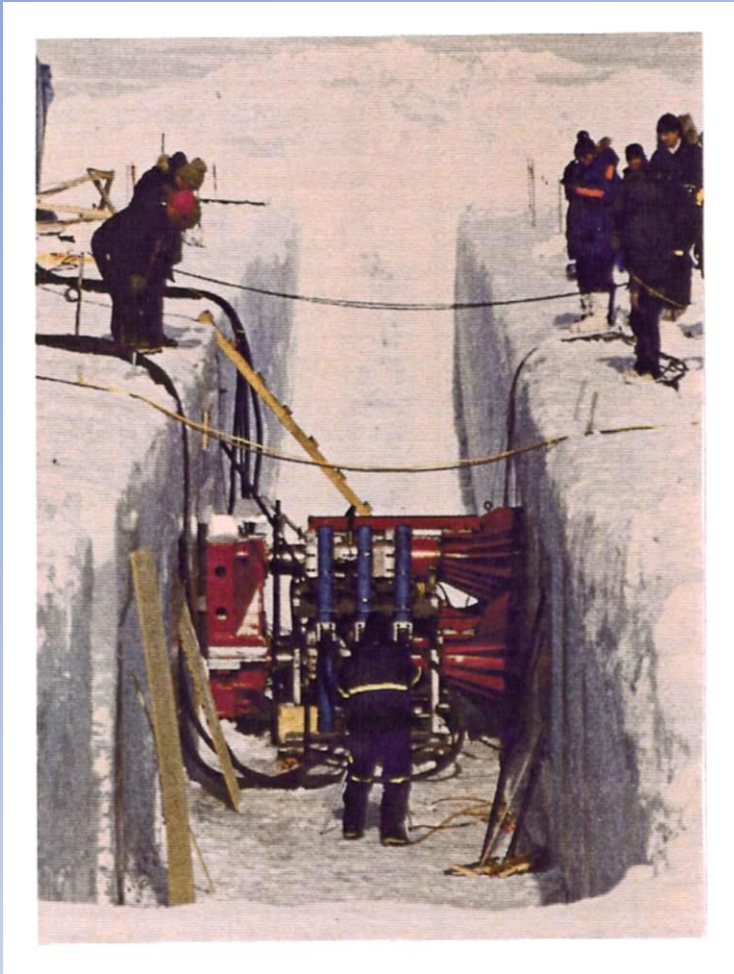


Some History of Ice Pressure Measurements

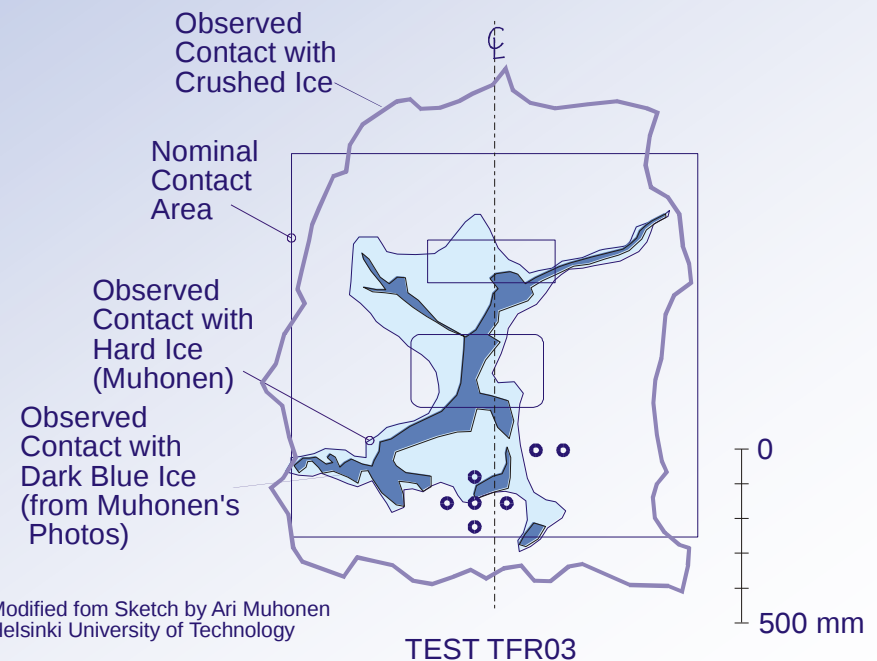
- Canmar KIGORIAK had an ice load panel
- First 'contiguous' ice panel array



Some History of Ice Pressure Measurements

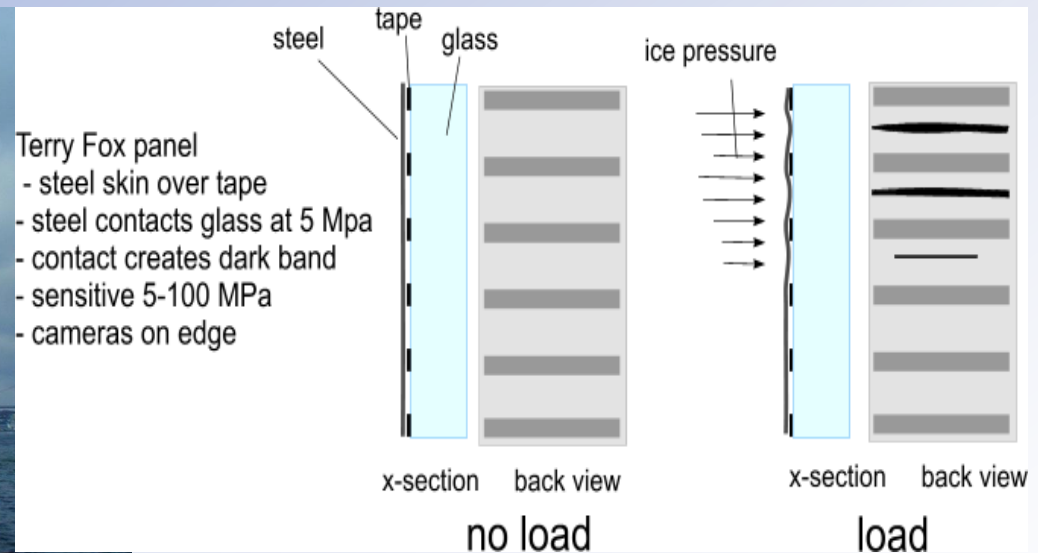


- called Hobson's Choice
- 'controlled' tests of load, pressure and indentation (to 12MN)
- Contact patterns were complex with very high local pressures



2001 Iceberg impact tests

- Terry Fox – Beaufort 2nd Gen.
- Bob's load panel on shoulder
- (+ s.g. on webs + Motan)



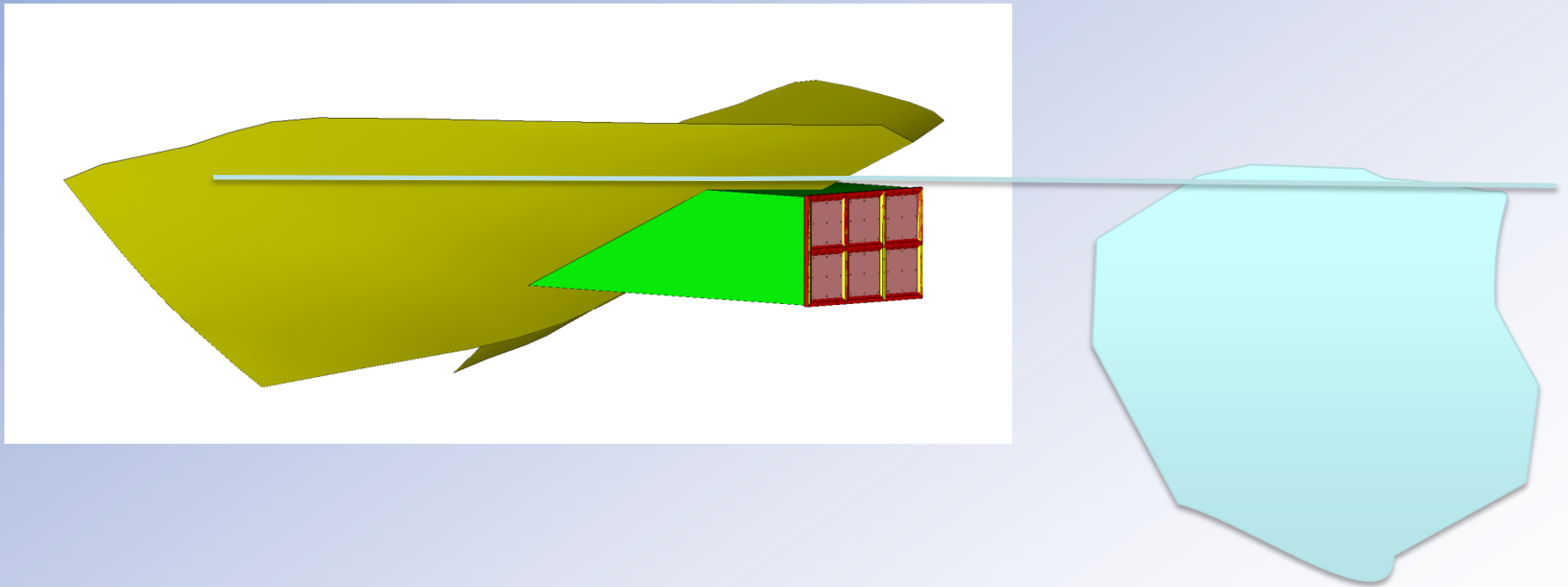
2001 Iceberg impact tests

- video



new ice pressure load panel

Proposed new field tests on Terry Fox -



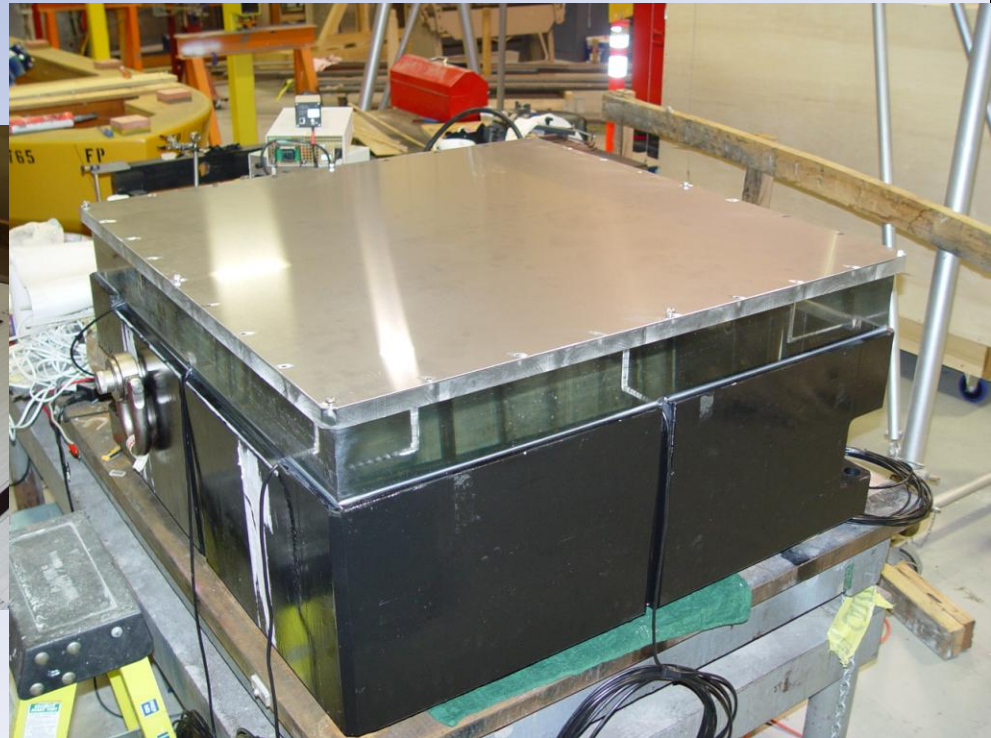
new ice pressure load panel

panels – 1m x 1m

18" thick clear acrylic

Narrow strips of acrylic

Robust opto-mechanical panel



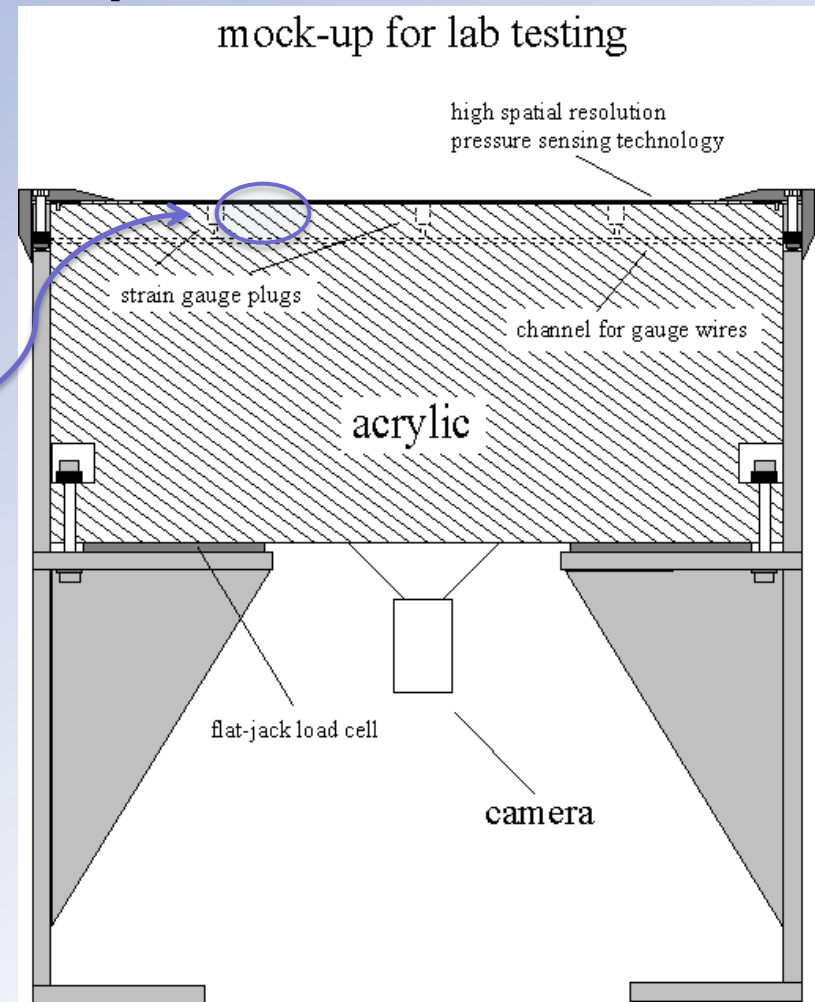
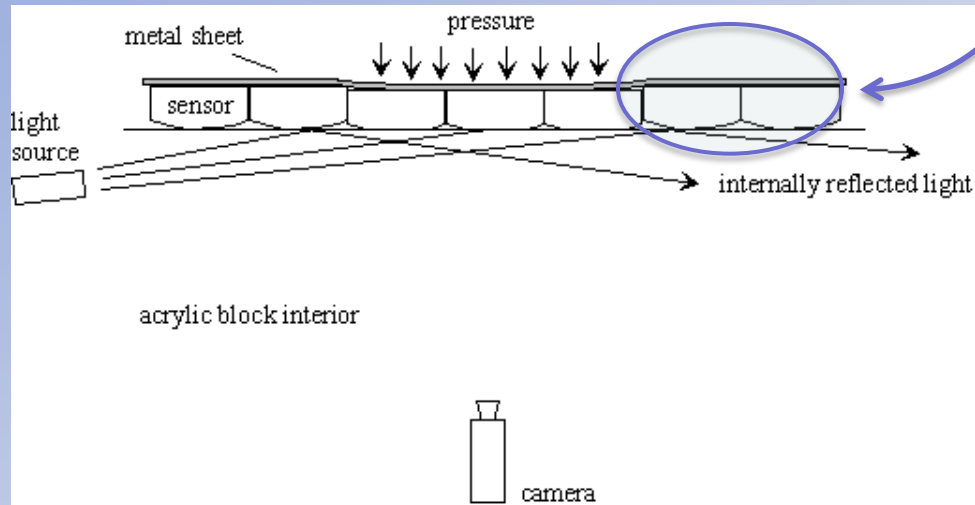
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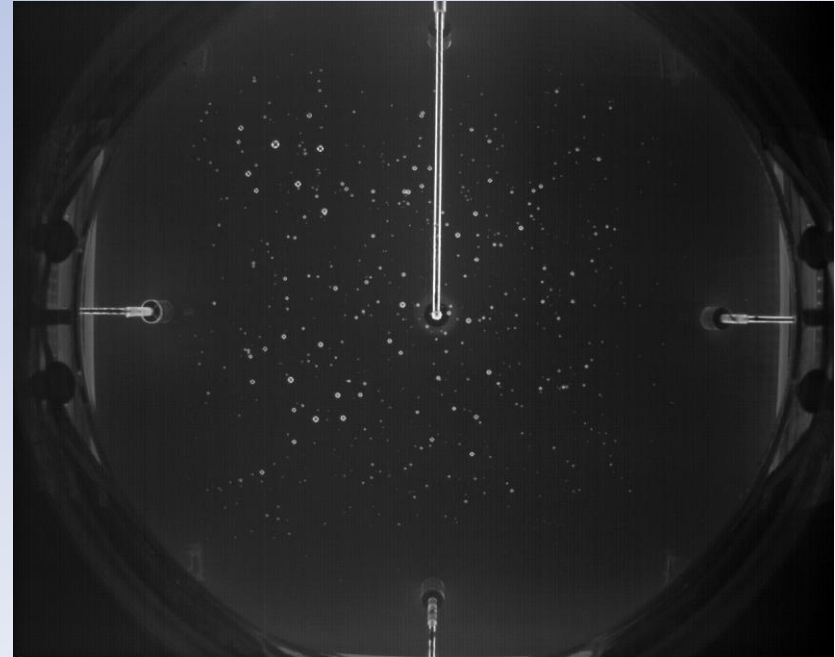
Narrow strips of acrylic

Robust opto-mechanical panel



new ice load panel data

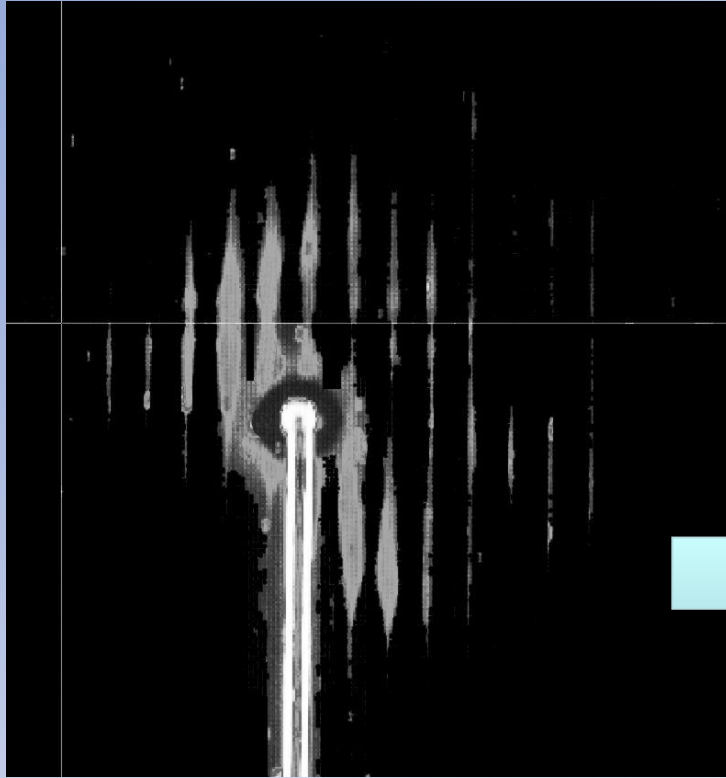
Video of ice test



Video from sensor camera



new ice load panel data



Sensor Camera Image

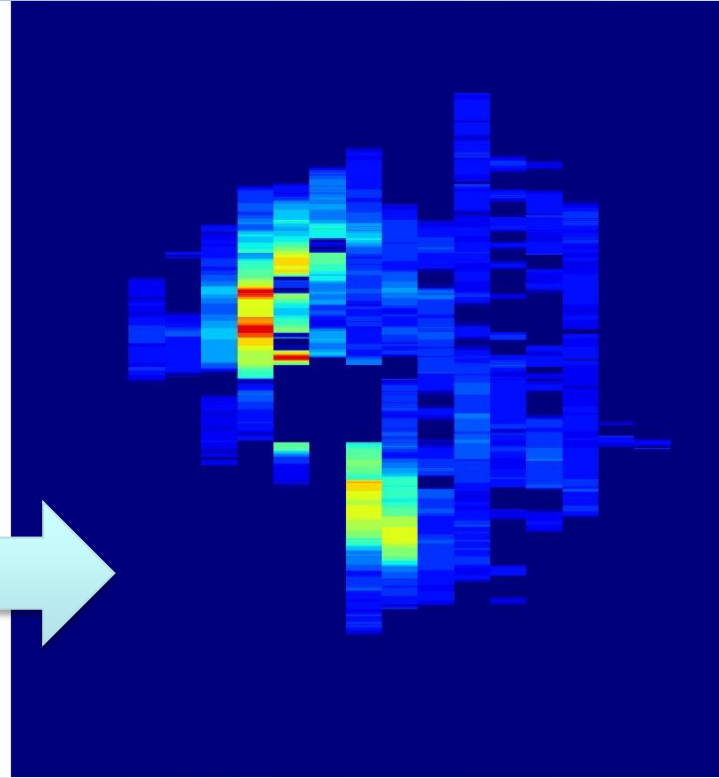
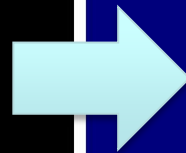
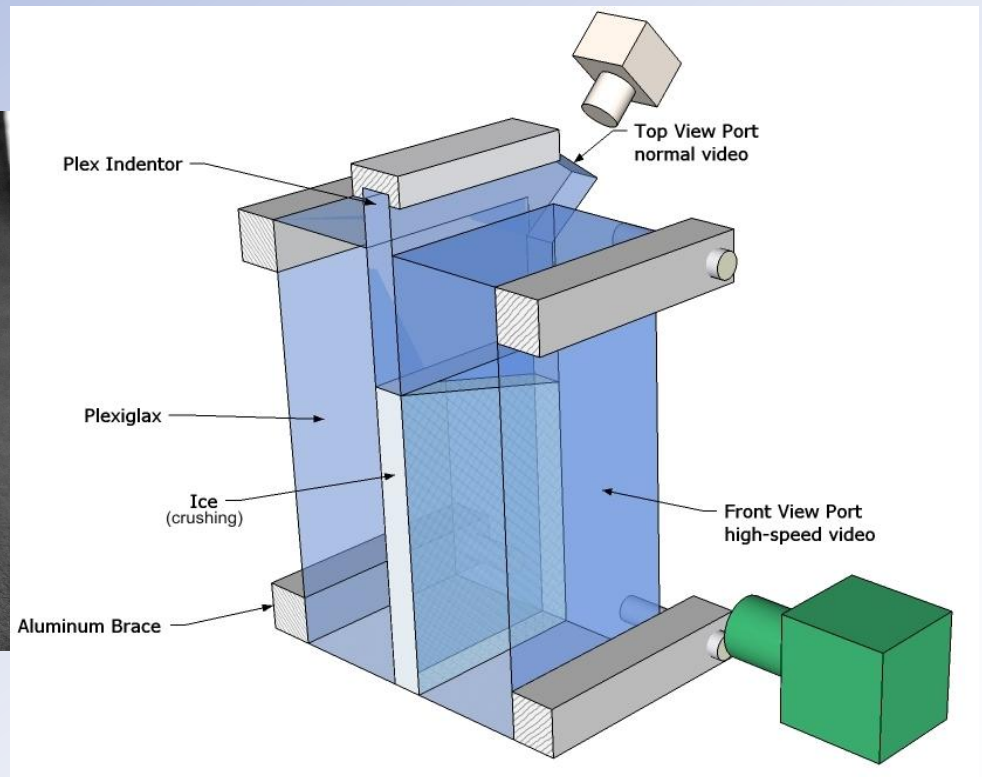
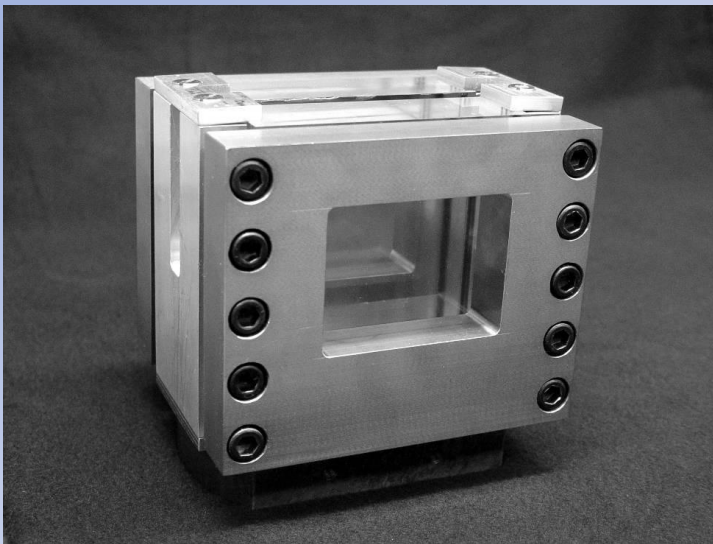


Image converted to pressure pattern



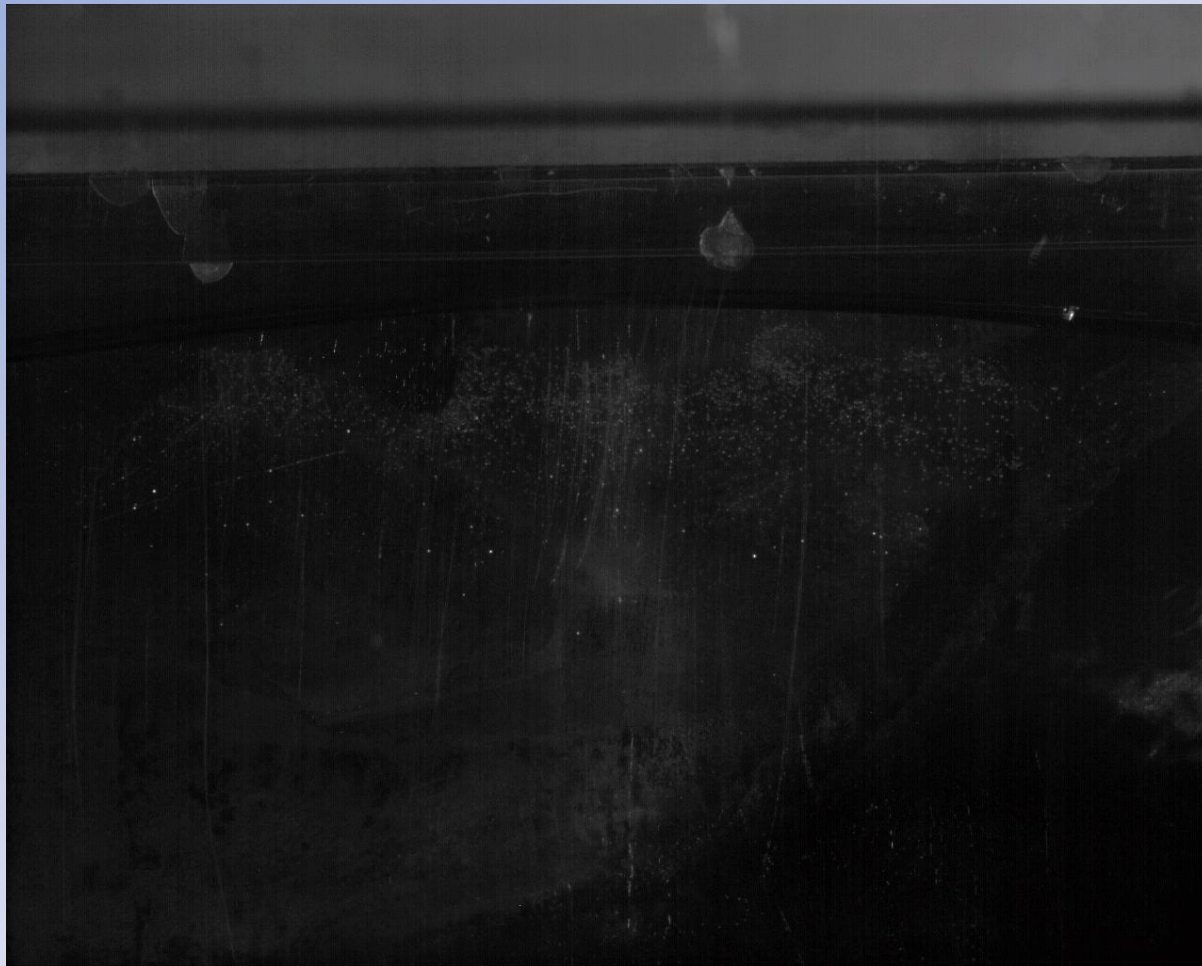
Thick Section Ice Crushing Tests

- 'idea' is to crush a x-section of ice and film (at high speed) through the window
- The window holds the section as if the ice were much thicker



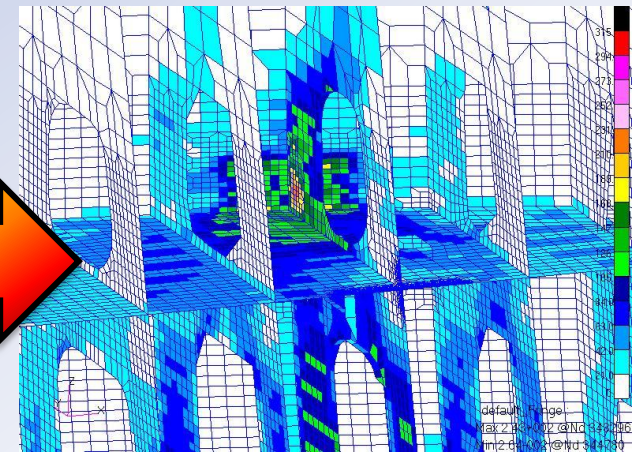
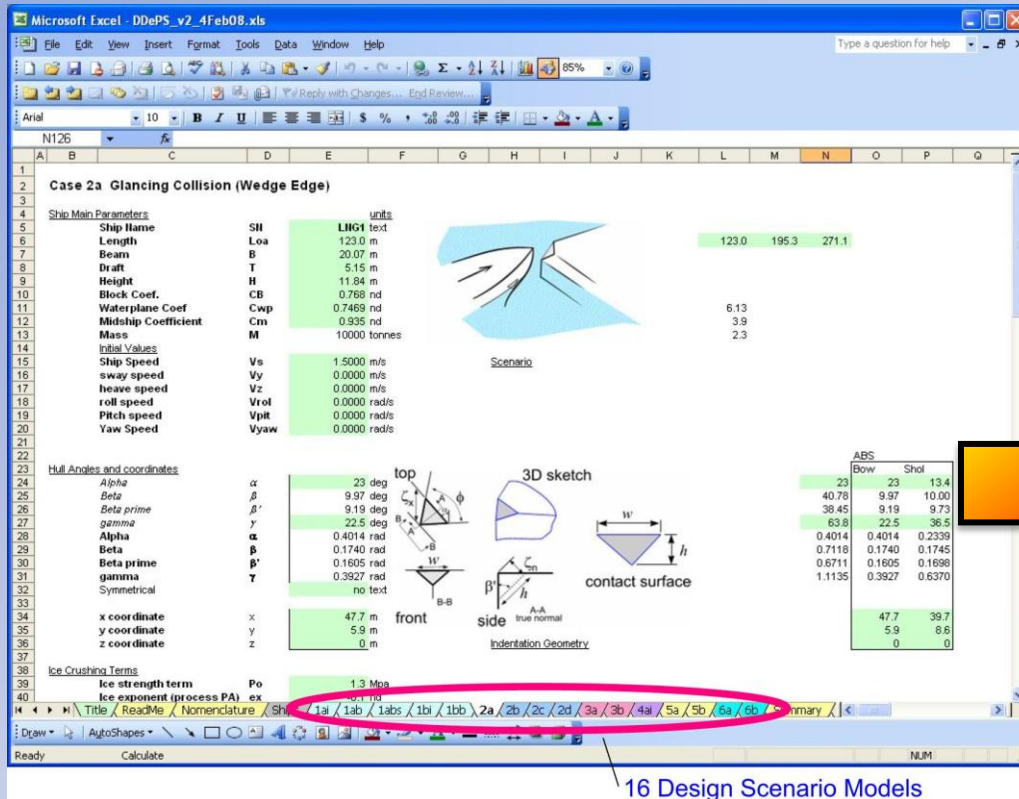
Thick Section Ice Crushing Tests

- video



new directions in arctic ship& structure design and assessment

Expansion of Polar Rules concept – scenario based design



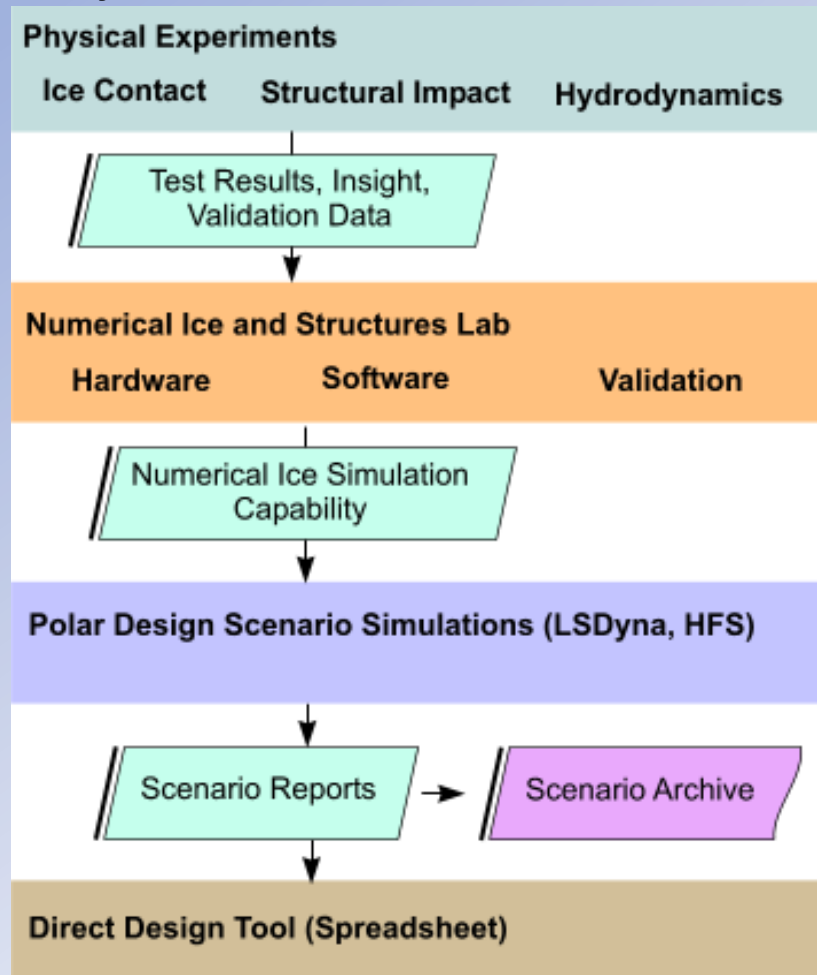
Finite element analysis

DDePS – Direct Design of Polar Ships



STePS² - Sustainable technology for Polar Ships and Structures

- 6M\$ AIF/Industry/Memorial/IOT project
- 5 years



Thank you for listening!

