Structural Condition Assessment - Extending the Use of In-service Wood

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Research & Technology Transfer Partners

University of Minnesota Duluth
Natural Resources Research Institute
(former Air Force SAGE Building)

USDA Forest Products Laboratory

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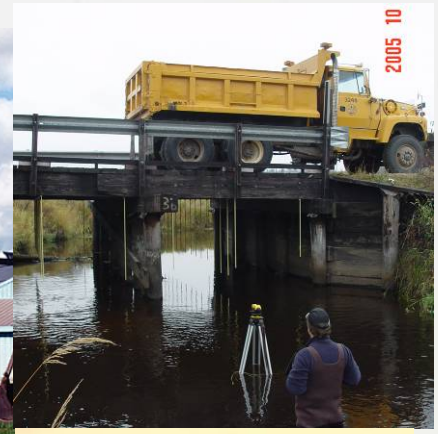
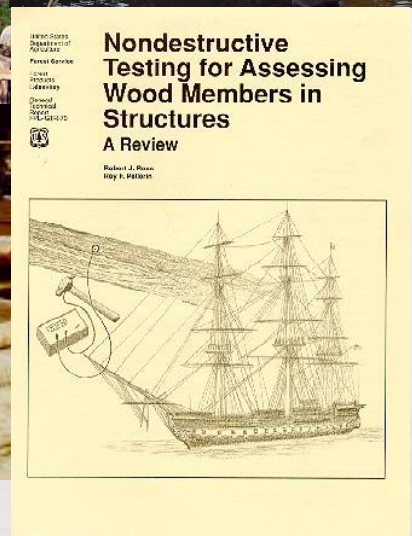
Our wood condition assessment efforts have focused on:

1. Conducting fundamental and applied research
2. Presenting on-site short courses through American Society of Civil Engineers
3. Preparation of user-friendly technical information and inspection manuals
4. Development and presentation of web-based portals and interactive webinars
5. Conducting on-site inspections of wood structures
   - Buildings, bridges, and ships
6. Ongoing research focus on wood systems

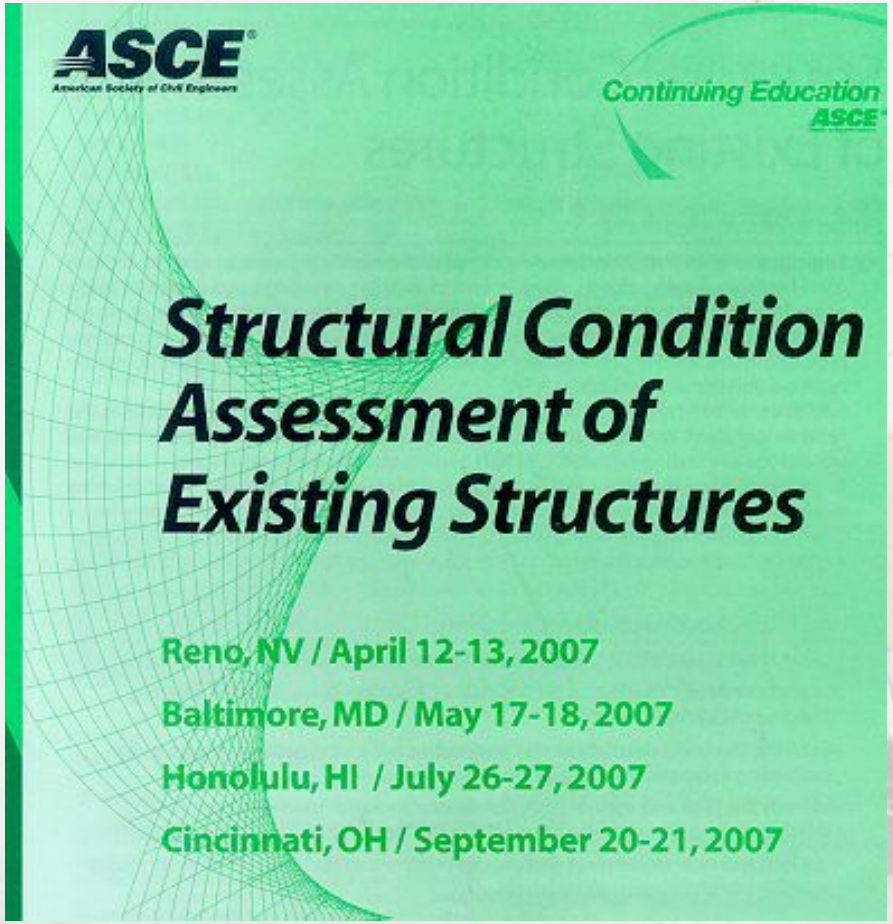
Nondestructive Evaluation Fundamental and Applied Research

- Mechanical Property Characterization
- Defect Identification
- Technology Development / Implementation
  - Trees, logs
  - Veneer, lumber
  - Composites
  - Wood-based structures





ASCE On-Site Short Courses



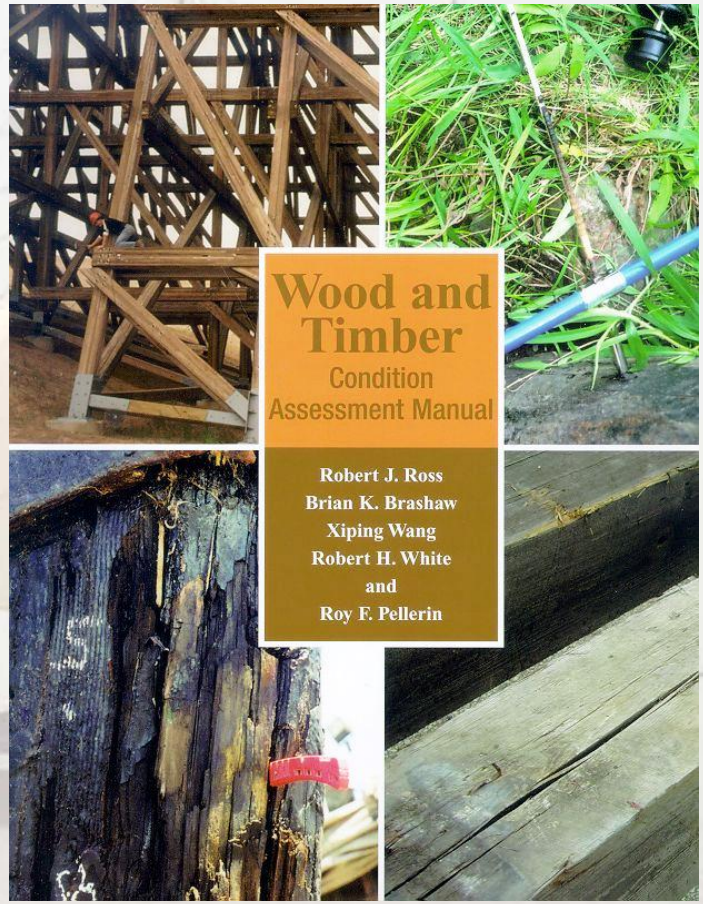
Course Objectives

- To present an overview of nondestructive evaluation (NDE) techniques for wood property evaluation
- To present an overview of methods that are used to inspect wood structures
- To present case study examples where these techniques are used

Wood and Timber Condition Assessment Manual

Chapters

- Visual inspection
- Drilling, coring and probing techniques
- Stress wave timing techniques
- Post-fire assessment of structural wood members
- Condition summary reports



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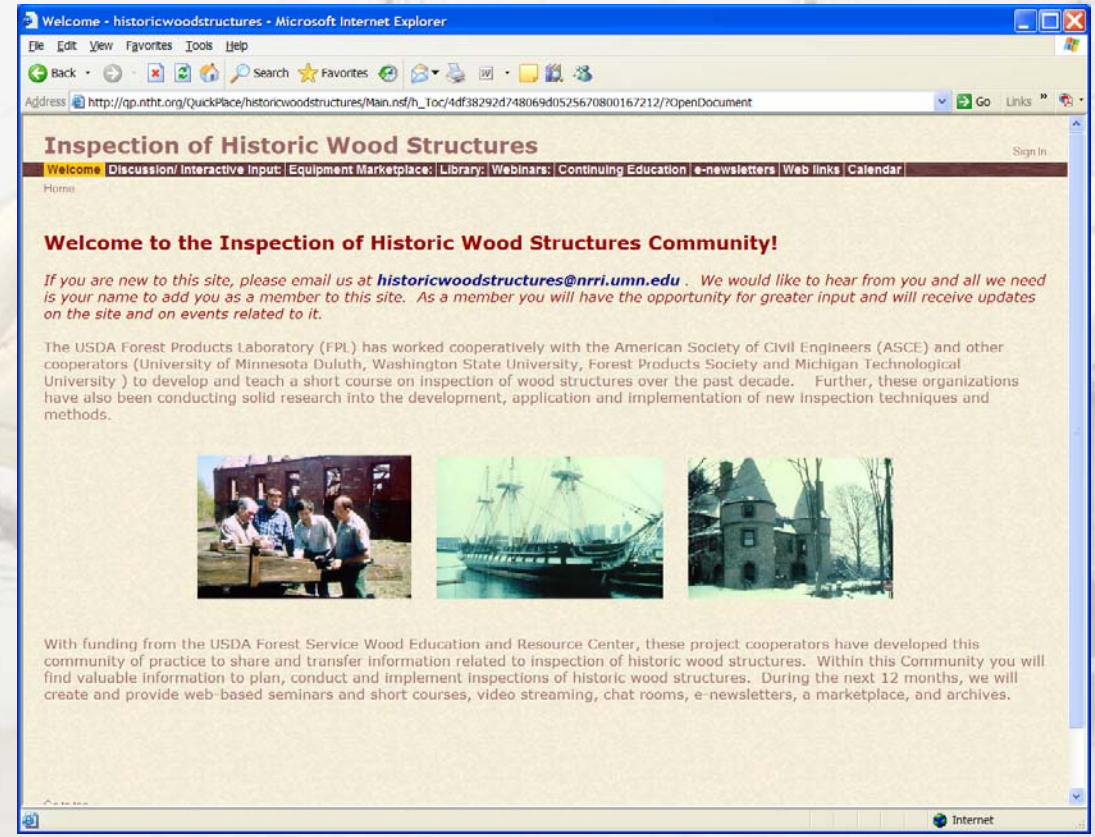
Inspection of Historic Wood Structures Community of Practice

http://qp.ntht.org/historicwoodstructures



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Inspection of Historic Wood Structures

Welcome to the Inspection of Historic Wood Structures Community!

If you are new to this site, please email us at ***historicwoodstructures@nrri.umn.edu*** *. We would like to hear from you and all w is your name to add you as a member to this site. As a member you will have the opportunity for greater input and will receive up on the site and on events related to it.*

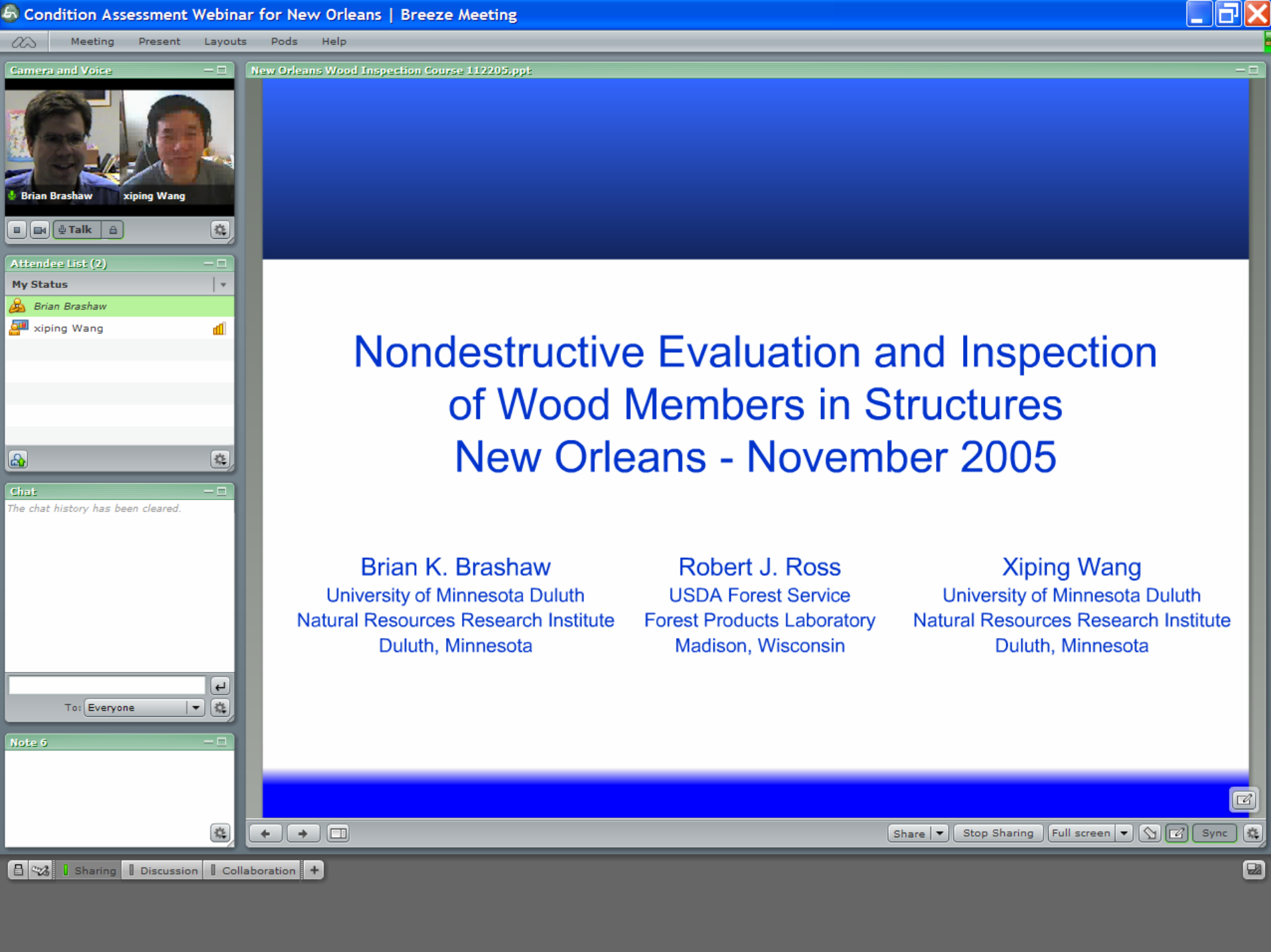
The USDA Forest Products Laboratory (FPL) has worked cooperatively with the American Society of Civil Engineers (ASCE) and oth cooperators (University of Minnesota Duluth, Washington State University, Forest Products Society and Michigan Technological University) to develop and teach a short course on inspection of wood structures over the past decade. Further, these organizat have also been conducting solid research into the development, application and implementation of new inspection techniques and methods.

With funding from the USDA Forest Service Wood Education and Resource Center, these project cooperators have developed this community of practice to share and transfer information related to inspection of historic wood structures. Within this Community find valuable information to plan, conduct and implement inspections of historic wood structures. During the next 12 months, we create and provide web-based seminars and short courses, video streaming, chat rooms, e-newsletters, a marketplace, and archiv

Web Seminars "WEBINARS" Component

- City of New Orleans; post Katrina
- Grey Towers National Historic Site – Milford, PA
- WAPAMA Schooner National Historic Monument - San Francisco, CA
- Cheboygan River Front Range Light Station - Cheboygan, MI
- Keweenaw National Historic Park, Quincy Mine Unit - Hancock, MI

From Duluth and Madison to New Orleans


Condition Assessment Webinar for New Orleans | Breeze Meeting
Meeting
Present
Layouts
Pods
Help
Camera and Voice
Brian Brashaw
xiping Wang
Talk
Attendee List (2)
My Status
Brian Brashaw
xiping Wang
Chat
The chat history has been cleared.
To: Everyone
Note 6
New Orleans Wood Inspection Course 112205.ppt
Nondestructive Evaluation and Inspection of Wood Members in Structures New Orleans - November 2005
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Share
Stop Sharing
Full screen
Sync
Sharing
Discussion
Collaboration

On-site Inspections of Wood Structures

- Wood Structures
  - Commercial, residential, agency (National Park Service, US Forest Service)
- Timber Bridges
  - US Forest Service and Minnesota Department of Transportation
- Historic Wooden Ships
  - USS Constitution, US Brig Niagara, CA Thayer, Wapama

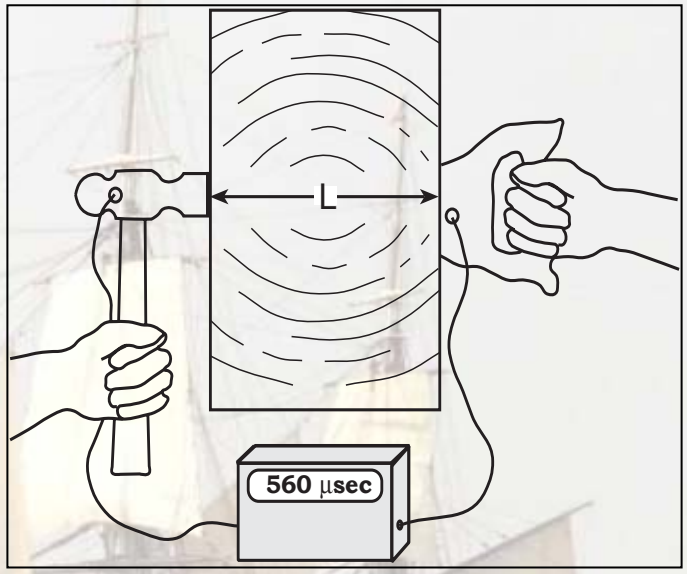
In-Place Assessment Methods

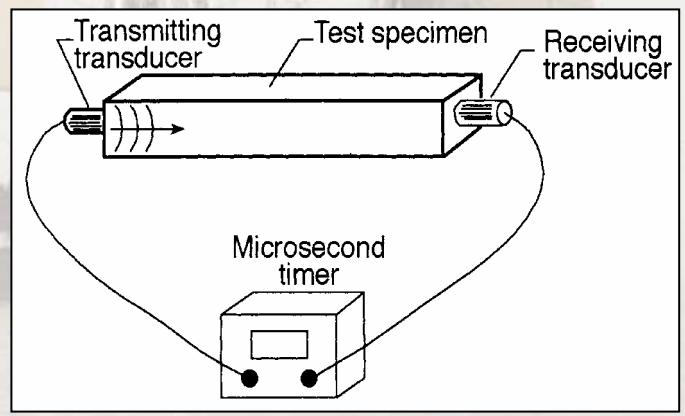
Condition Assessment Techniques

- Conventional Inspection Methods
  - Visual
  - Probing
  - Sounding
  - Coring
  - Moisture content
- **Stress wave timing**
  - ultrasound or impact induced
- **Resistance micro-drilling**

Stress Wave Timing

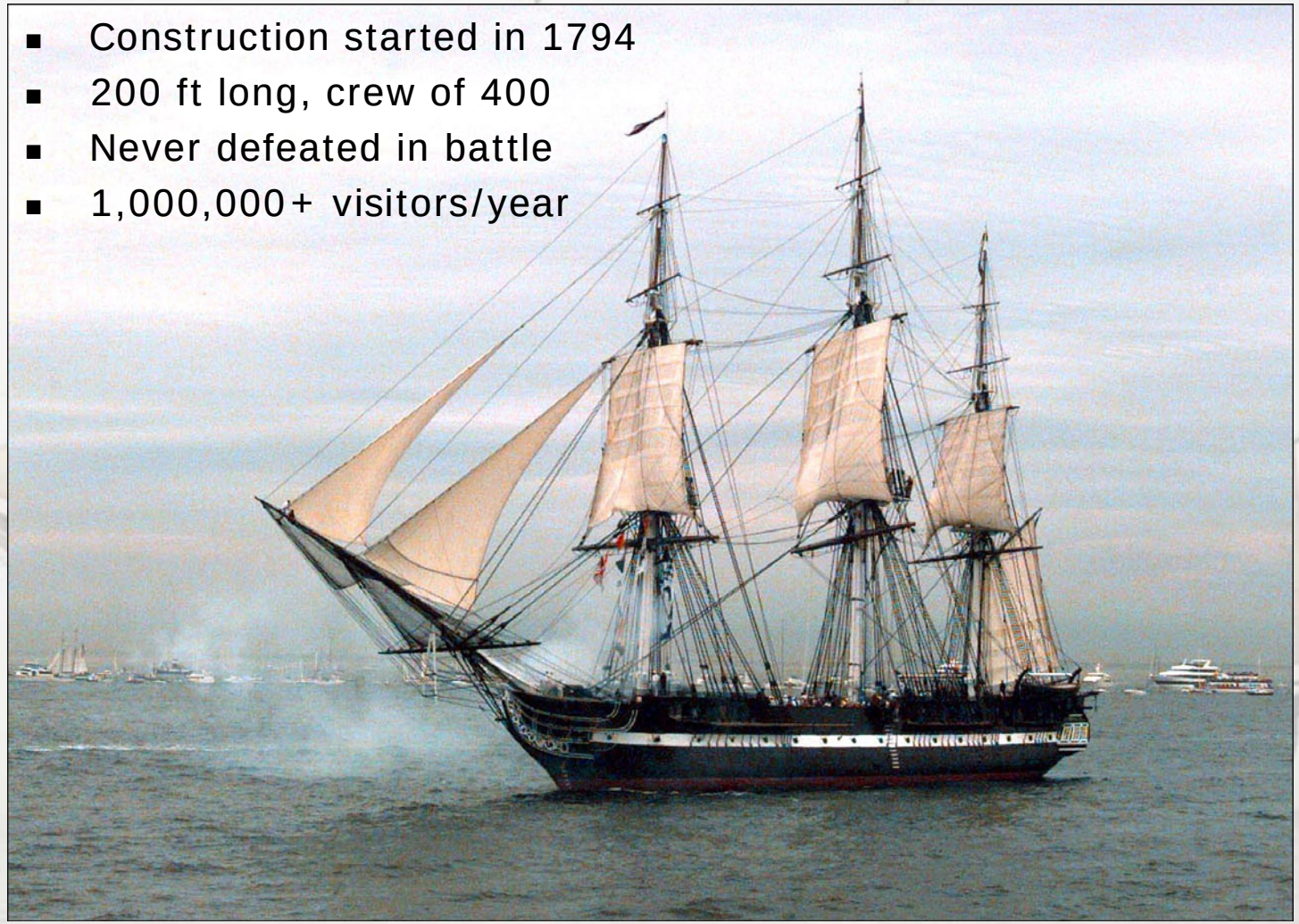
- Stress wave is induced into a sample
  - Ultrasound
  - Impact
    - Accelerometer monitors wave and starts timer
    - Backside accelerometer monitors the waves arrival and stops the clock
    - Timer displays transit time or velocity





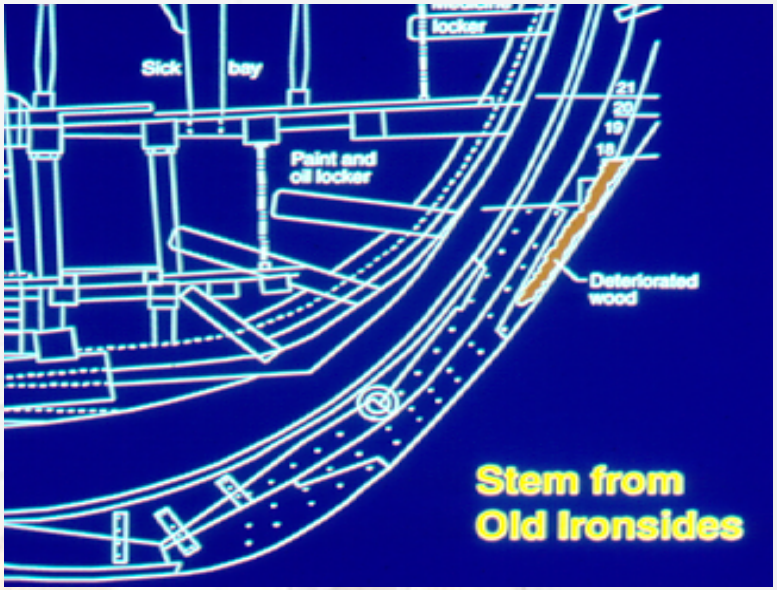
USS Constitution

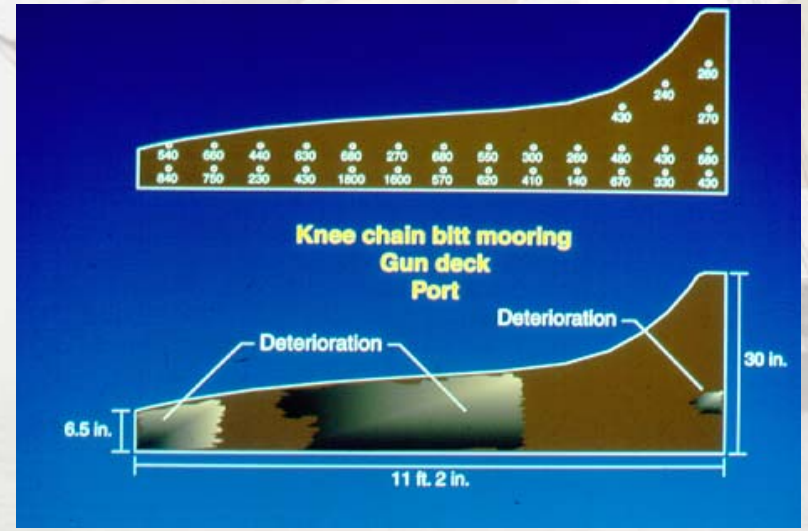
- Oldest commissioned ship in Navy

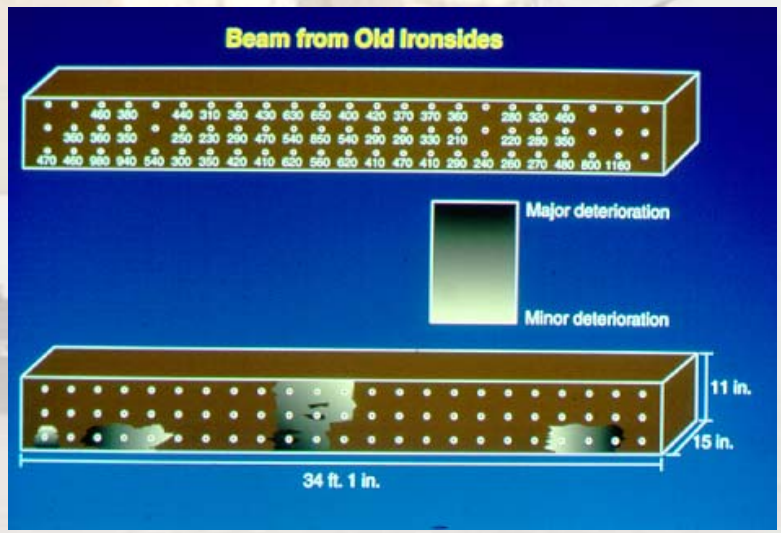


Decay mapping

- Beams
- Connections
- Wood/water/air interface
  - Waterline of stem







Wapama

- A Historic wooden ship (NHL)

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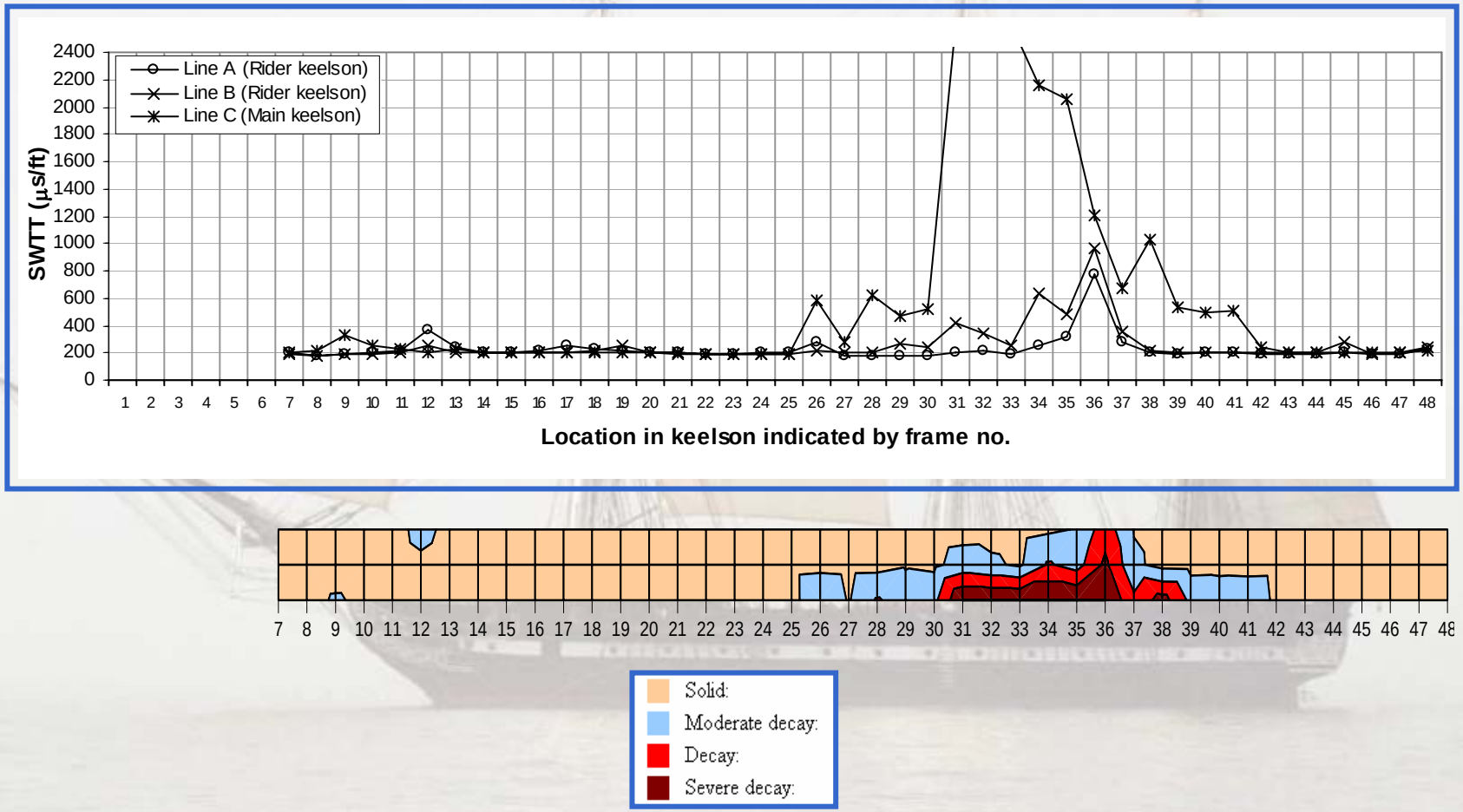
Keelsons



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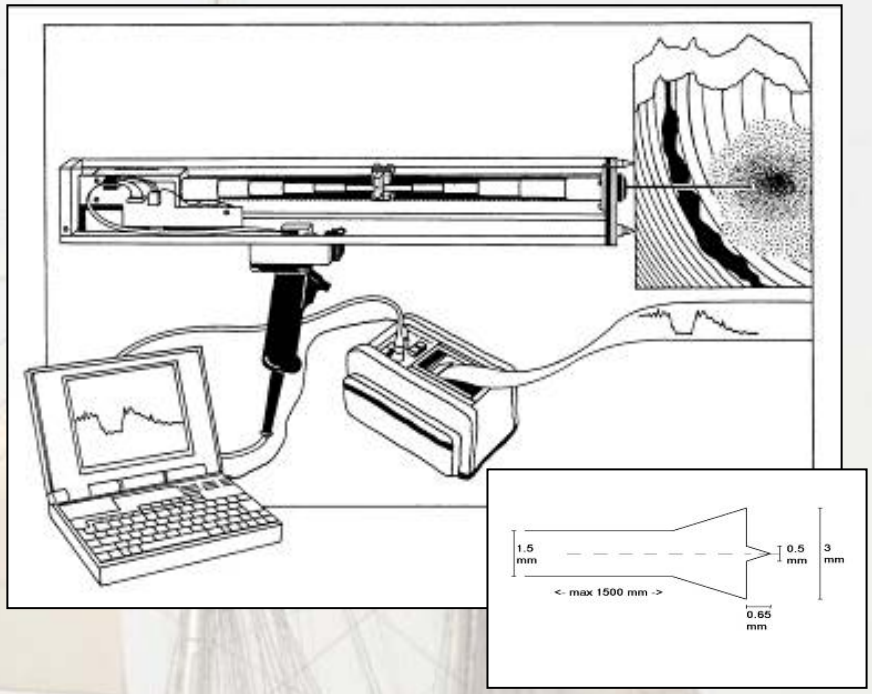
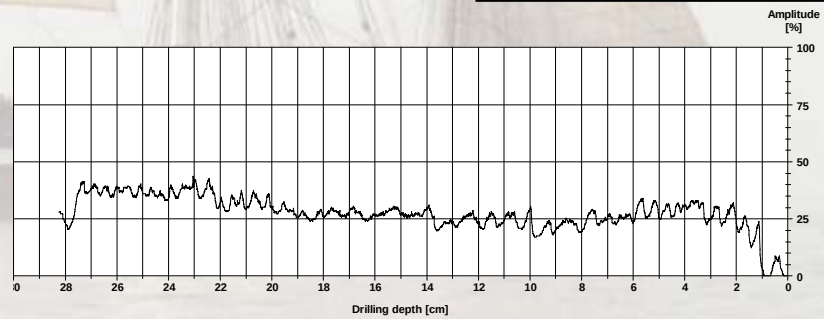
Resistance Micro-Drilling

- Resistance drilling systems to locate decay and termite damage
- Concept:
  - Drill resistance is well correlated to wood density
  - Measure the relative resistance as a rotating drill bit is driven into the wood.
  - Display relative density profile





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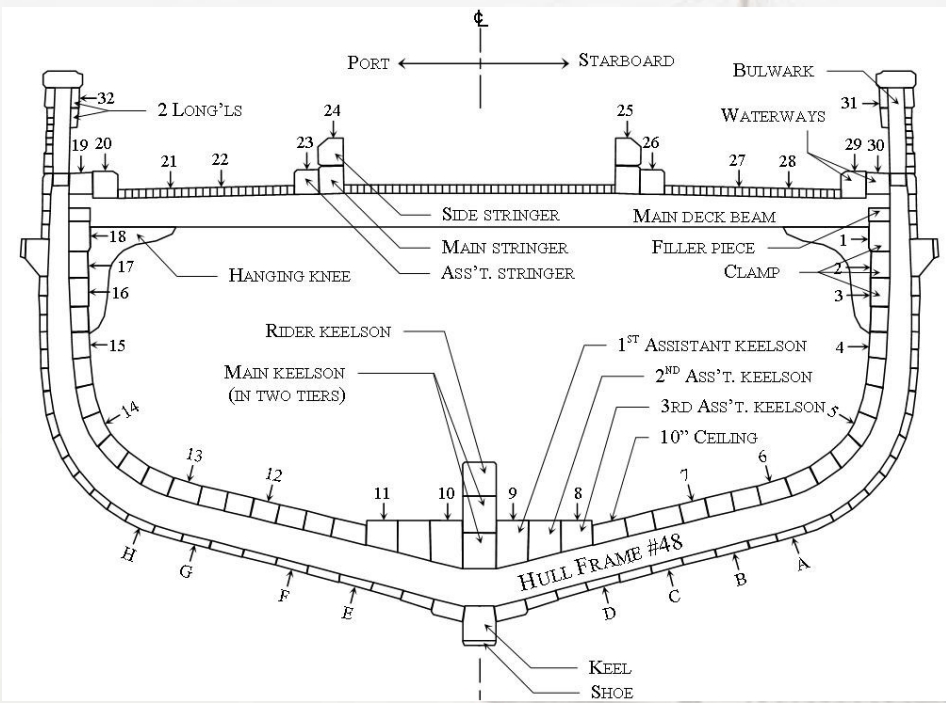
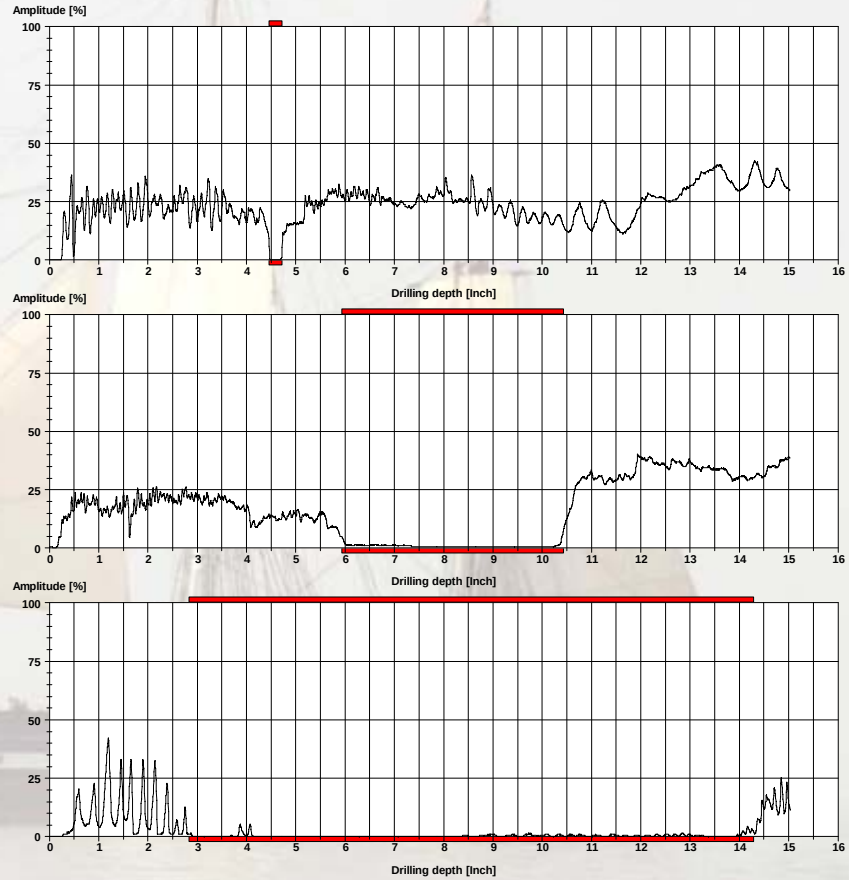
Micro-drilling test

- Wapama





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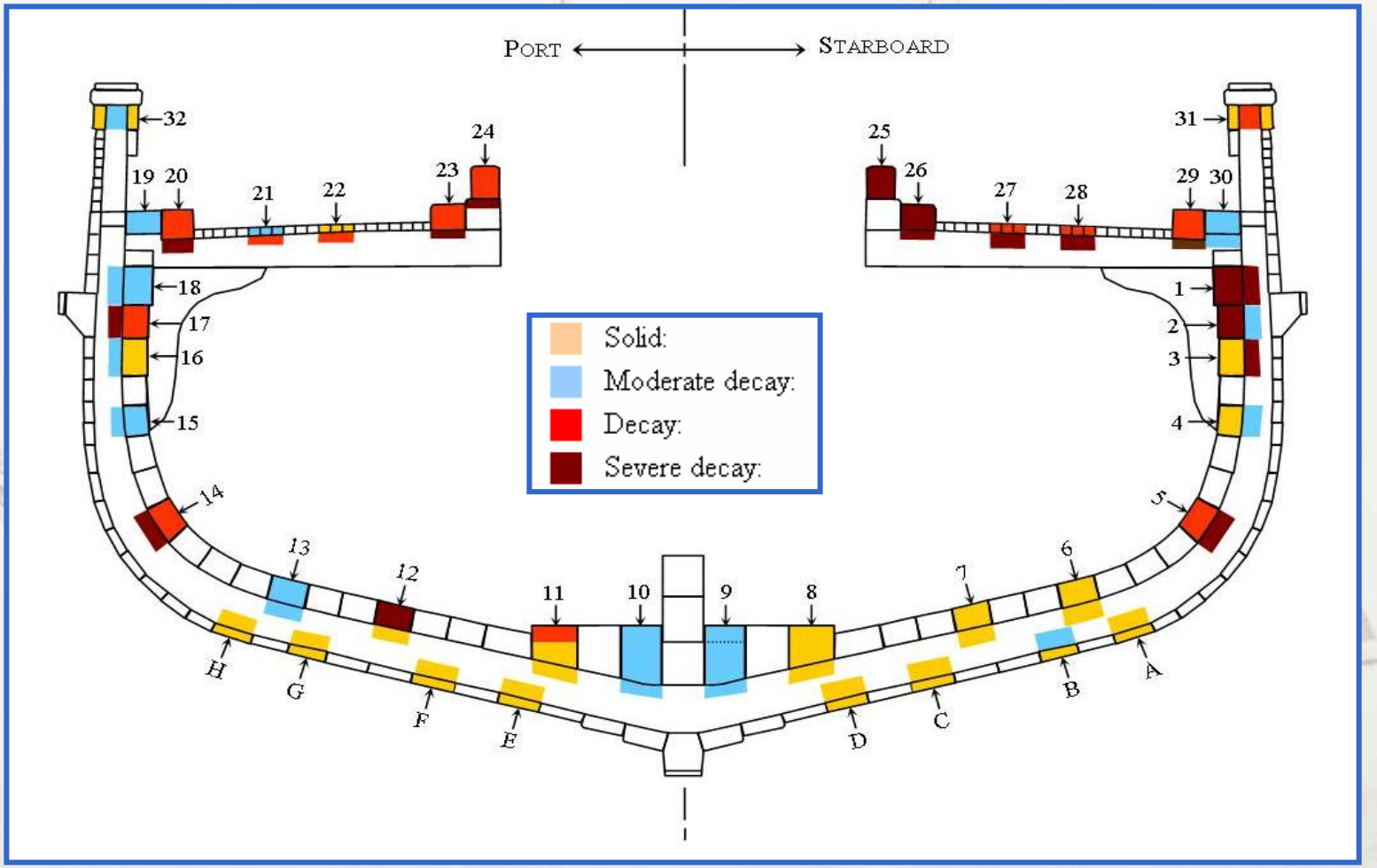
Mapping of physical conditions

- Wapama



Ongoing Research Focus

- Systems Inspection

- **Concept** – Deterioration of wood structures reduces strength and stiffness of wood components, and thus could affect the dynamic behavior of the system.
- **Goal** - Develop cost-effective and accurate NDE methods for assessing the condition of wood structures based on analysis of fundamental frequency of the superstructure and determine the global stiffness of the system.

We welcome future collaboration!

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Thanks!

Questions?