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CLASSIFICATION

UNCLASSIFIED

SYSTEM NUMBER

511920



TITLE

Progress and Plans the Improved Ship Structures Maintenance Management \ (ISSMM\
Project

System Number:

Patron Number:

Requester:

Notes: Paper #46 contained in Parent sysnum #511874

DSIS Use only:

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Progress and Plans the Improved Ship Structures Maintenance Management (ISSMM) Project

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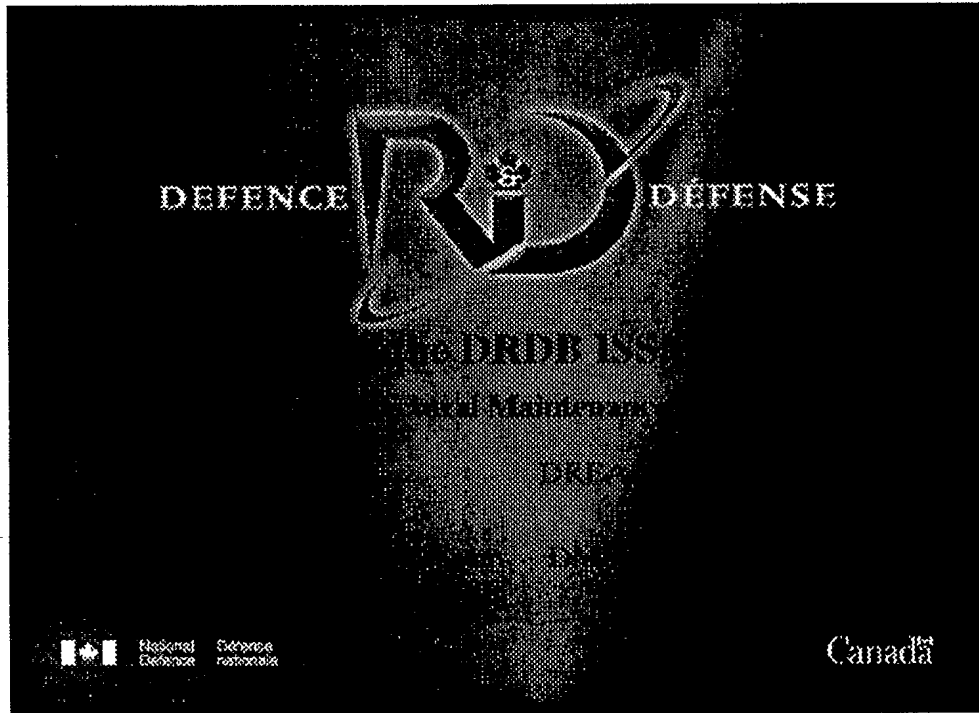
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ABSTRACT

The ISSMM project was initiated by DND in 1996 to provide a validated tool for engineers to use in making rational assessments of the effects of degradation and damage on a ship's structural capability to undertake a given mission. The project encompasses the integration of modern sea load prediction methods, finite element models, fatigue and ultimate strength analysis and an extensive data management system into an engineering software tool. ISSMM is the largest project involving ship structures R&D in Canada, with some components being used by and supported by other nations.

This paper discusses recent progress on ISSMM including the development of structural sea load cases from defined operational profiles, validation of load and response prediction methods via sea trials, an improved method for efficient production of detail finite element models, the object-oriented ship database management system developed for ISSMM, and the integration of load prediction codes and ultimate strength evaluation modules with structural finite element analysis. Example problems of the effects of corrosion on strength and of crack propagation will be discussed.



ISSMM

Questions to be Answered

What is ISSMM?

Why is ISSMM important?

How will ISSMM be developed?

Who will use ISSMM?

When will ISSMM be operational?

What is ISSMM?

ISSMM is a DRDB major project to produce a validated software tool to aid in the assessment of the structural capability of a damaged CF vessel to undertake a specific mission.



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What is the problem?

- ⇒ Current methods are for design not analysis
- ⇒ Need to address structural integrity and safety for damage or specific operations
- ⇒ ISSMM will allow improvements in assessing
 - Ship Structural Integrity and Safety
 - Ship Availability and Operational Capability
 - Maintenance Options for Reduced Costs
 - Impact of Major Updates (FELEX)and, allow updates to corrosion and crack limits in maintenance manuals



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How will the final product be used?

Operational Tool



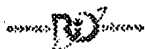
Problem Definition
Damage
Ship Operation

Load
Definition

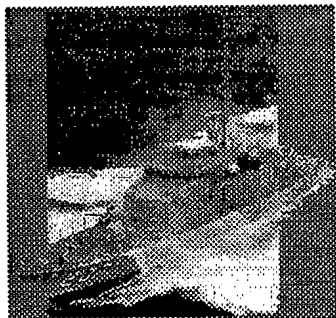
Damage
Modelling

Structural Analysis
Fatigue
Ultimate Strength

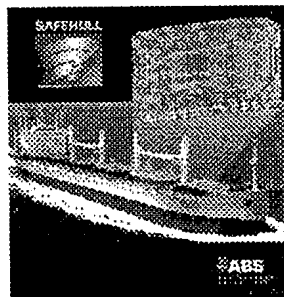
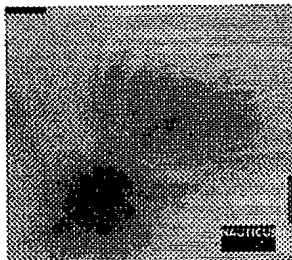
Risk
Assessment
Maintenance
Decision



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What are
others
doing?



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What are we doing?

- DRDB Major Project to develop tools - ISSMM
- \$4 million over 4 years plus significant in-house DREA effort
- RFP for Prime Contract at \$1.7 million, 1999
- Collaborative development with Allies
- Collaboration with industry



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In-Service Damage

Can the ship proceed to home port without repair?

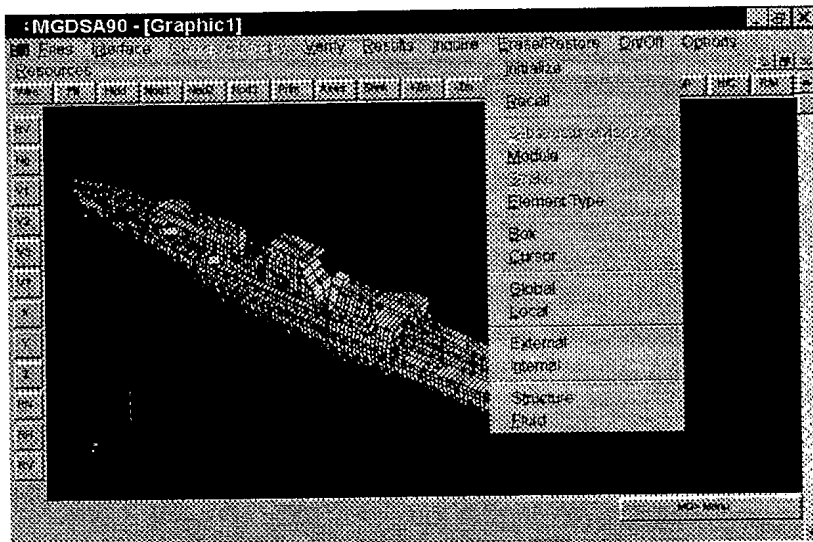
What limits should be placed on ship operations to ensure safety?

What is the most effective and cost efficient repair strategy?



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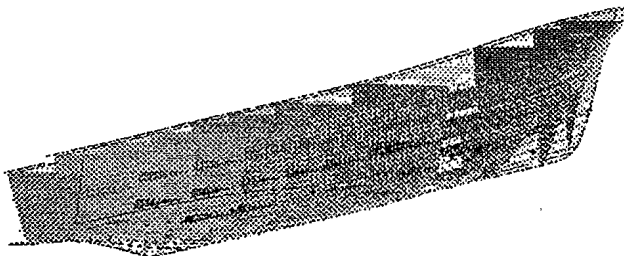
Software Tool



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Data Management - *Halifax Class*

Structure
 Materials
 Sea Loads
 FE Models
 Analysis Results



Hierarchical Object Oriented Data-manager (HOOD)

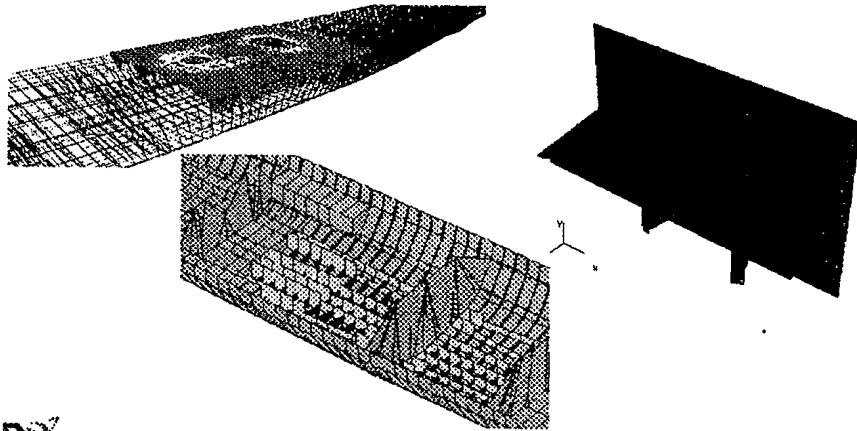
```
{ship..{deck..{grillage..{stiffened panel..{material..{loads..
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Structural Analysis

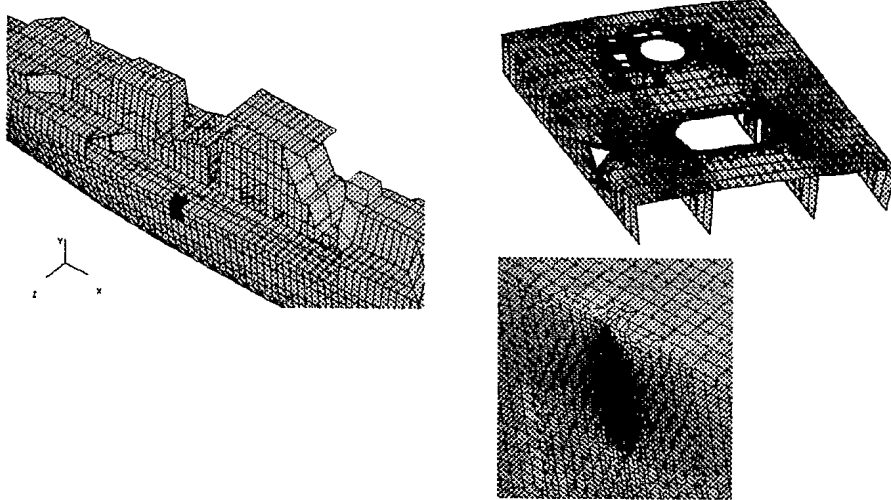
- Top-down finite element analysis of global hull structure and component details
- Rapid production of structural detail models



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Damage Modelling

- Damage from corrosion, cracking and deformation



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Materials Database

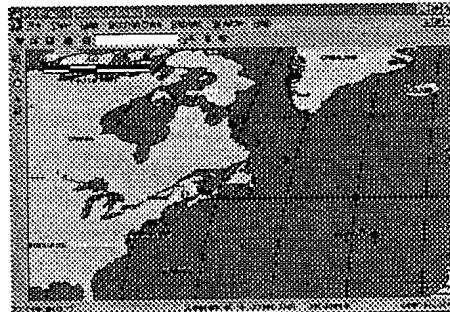
- ISSMM software to incorporate a material property database to allow models to be generated quickly.
 - Extensive testing of Halifax Class structural materials.
 - Data produced on yield strength, toughness, crack initiation and crack propagation.
- ISSMM software to include a number of fatigue initiation prediction methods.
- ISSMM software to include crack growth models incorporating spectral loads.



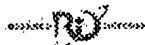
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Operational Sea Loads

Mission specific
sea load data



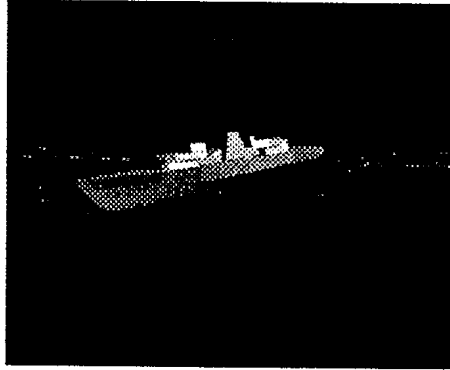
Extreme structural
loads from storm
events



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Dynamic Sea Load - Structural Response Calculations

Computer model of CPF responding to specific sea conditions



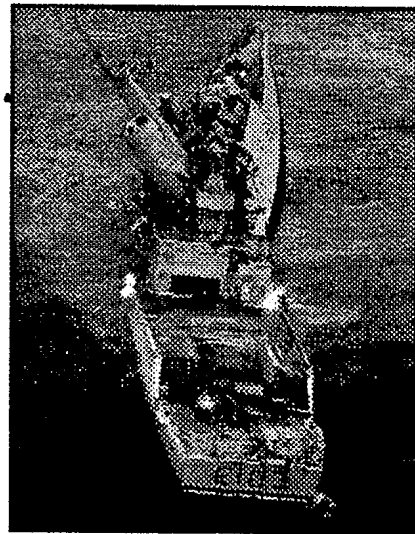
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Risk Assessment

For given damage and ship operation:

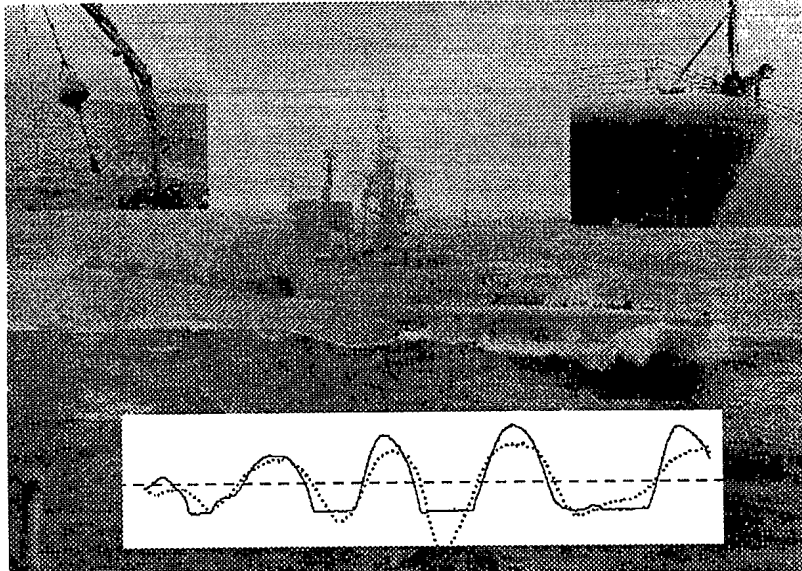
What is the change in safety level?

What is the probability of structural failure?



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Validation - Sea Trials - *HMCS NIPIGON*



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ISSMM **Questions Answered**

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