



RISPECT

Risk-Based Expert System for
Through – Life Ship Structural Inspection,
Maintenance and
New-Build Ship Structural Design

Nov. 2008 till Oct. 2011

Thematic Priority: Transport
Call: FP7-SST-2007-RTD-1 Sustainable Surface Transport
Topic: SST.2007.5.1.2. & SST.2007.5.1.1.
Instrument: Collaboration Project



Prof. Nigel Bartrop, Li Xu & Nabile Hifi
Naval Architecture and Marine Engineering
University of Strathclyde - Glasgow



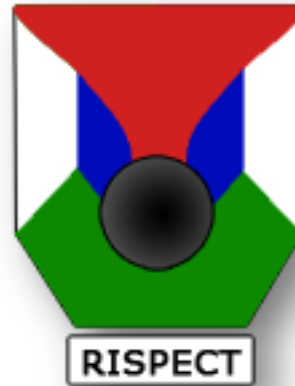
Aim of project

To intelligently use inspection results to improve safety of ships through better inspection and design

also...

To improve communications between different parties involved in a ship's structural safety

Partners





Product

Software tool to

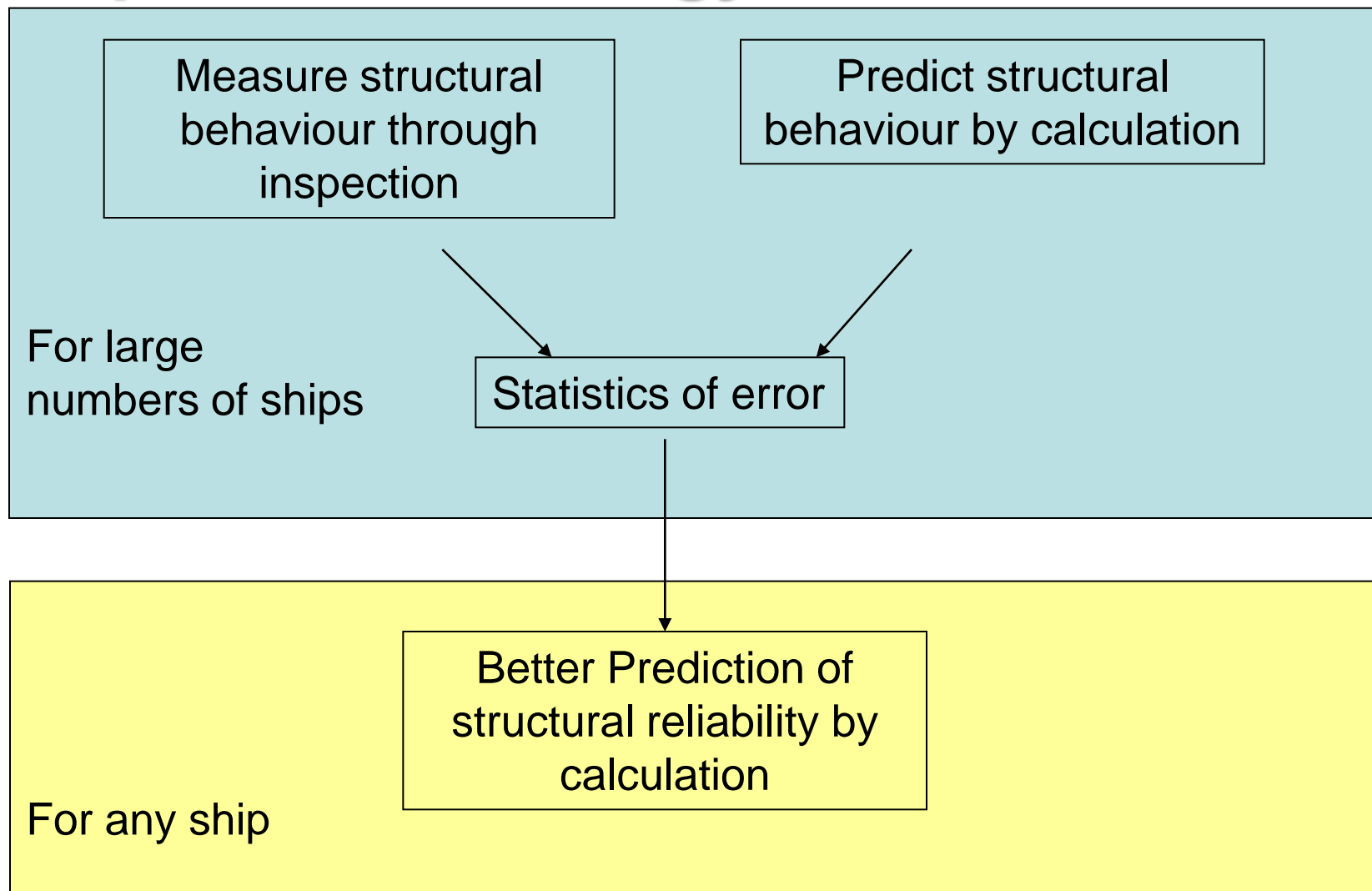
- Improve inspection planning.
- Improve design assumptions.
- Improve communications between manager – repair yard – owner - class

Research

- Improve understanding of bias and uncertainty in analysis.
- Describing and classifying ship structure and defects for structural and statistical analysis.
- Rapid fatigue/fracture analysis of ship details with sharp corners.
- Structural system reliability and risk methodology.
-



Rispect Methodology





Respect network structure

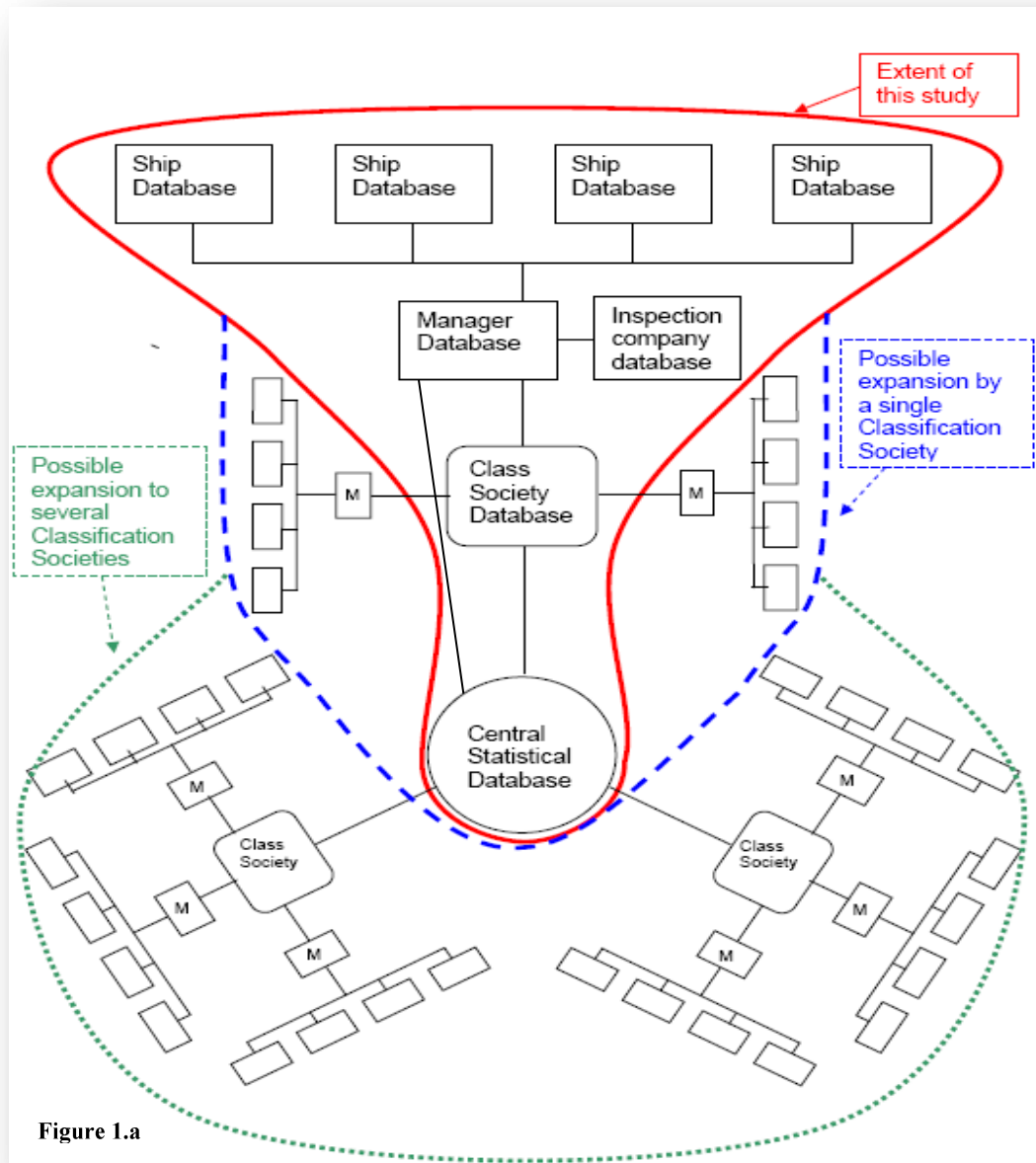
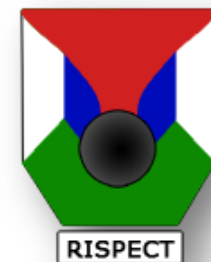
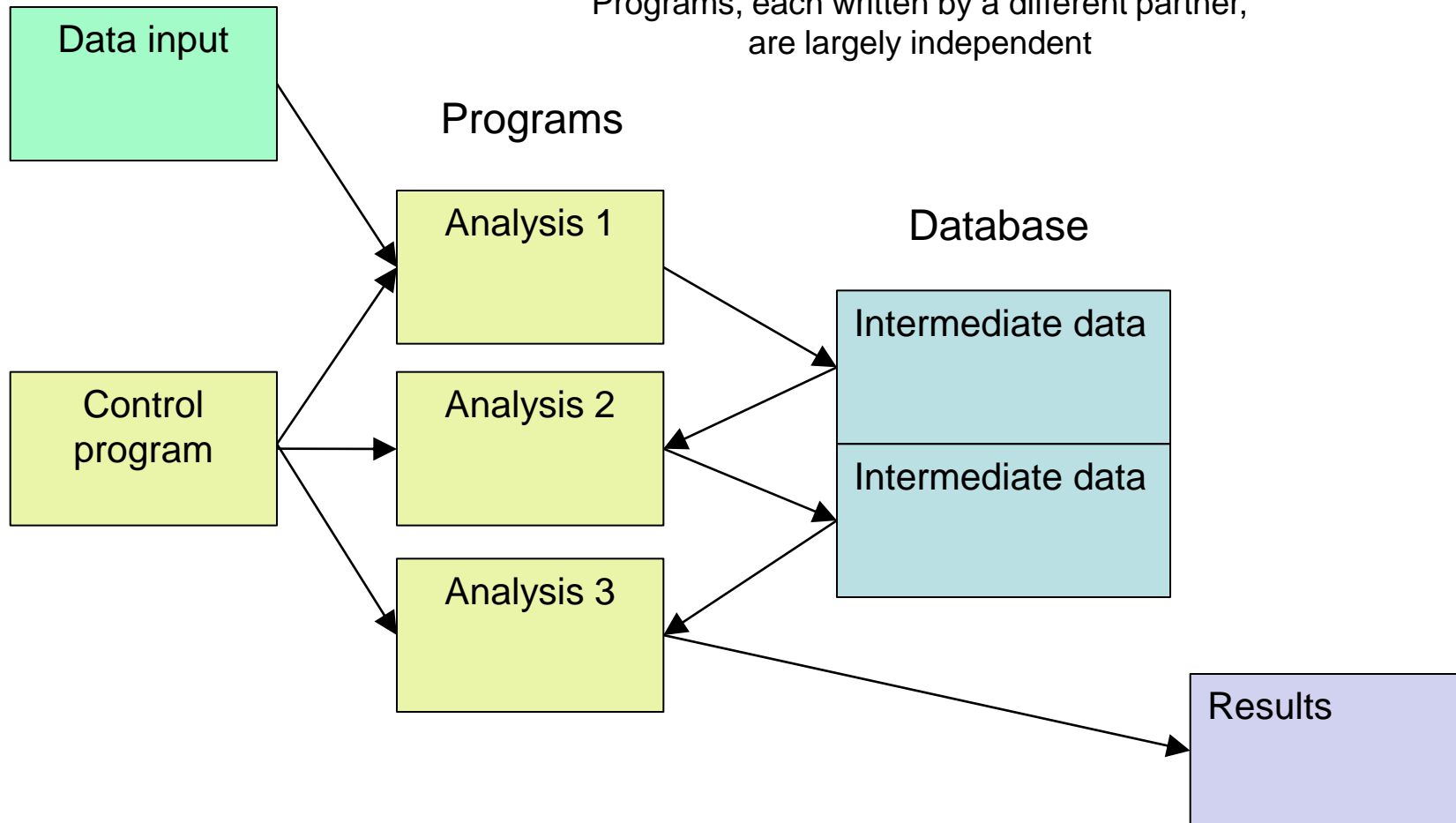


Figure 1.a



Simplified software design

Programs, each written by a different partner,
are largely independent

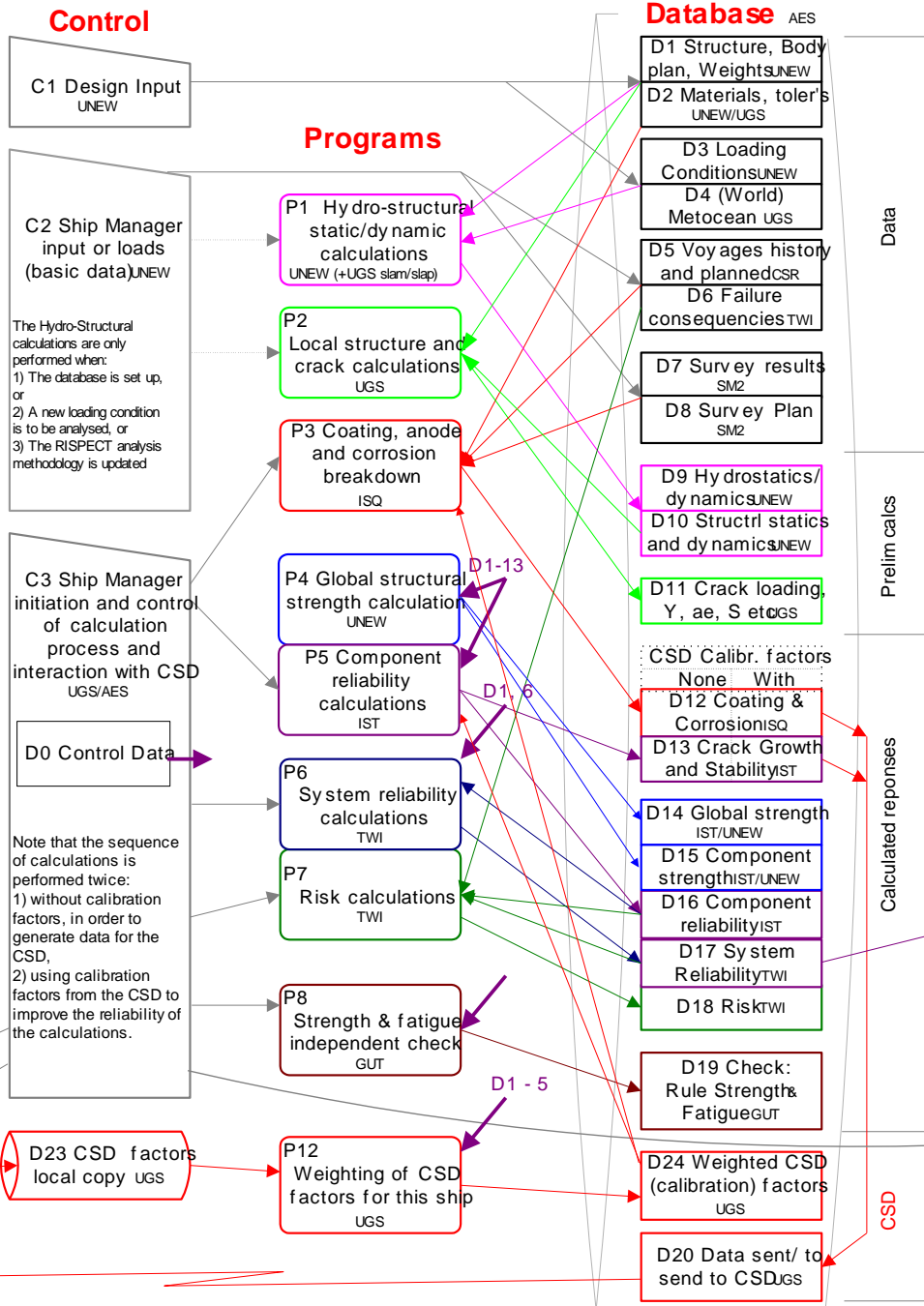


RISPECT - V2 - r3 ENGINEERING CALCULATIONS

Notes: 1) The remote CSD contains data for all ships and is controlled by the CSD manager

2) Remainder of system, as shown, applies to one ship and is under the control of the Ship Manager.

3) D0 Control Data is shown with C3 but will be part of the database, so the programs will be started by C3 but will refer to D0 for information defining the calculations they are to perform.



Revisions Version 1
 r2: 25 October 2009
 C2 instead of C3 initiates A3
 April 2010
 r3: CSD updated to include separate raw-data

Version 2 June 2010
 r1: Strength calculations performed within structural reliability calculation (previously strength and sensitivities pre-calculated). Numbering changed. Diagram reflected. Reports added
 r2: 14 July 2010
 D0 Control data added within C3
 Numbering changed
 program codes changed from A to P
 r3 18 July 2010
 CSD layout and numbering changed
 P21: Fleet reliability added
 P3 'anode' added

Raw data from other ships: same fleet and other fleets

Control of interaction with CSD

Note that the sequence of calculations is performed twice:
 1) without calibration factors, in order to generate data for the CSD,
 2) using calibration factors from the CSD to improve the reliability of the calculations.

System reliability from other ships in fleet

Printer output from each program
 This is for obtaining a detailed understanding of the results. The information produced by the reporting programs should usually be sufficient for the ship manager

Reports for:
 Manager
 Owner
 Inspectors
 Ship yard
 Class
 Flag
 Port state

Universities of Glasgow and Strathclyde
Statistical database, Fracture, Environment

Atlantec Enterprise Solutions
Data base technology

Bureau Veritas:
Link to Class society database

CONS.A.R
Link to shipping companies & Dissemination

Gdansk University of Technology
Independent checking software

Instituto de Soldadura e Qualidade
Corrosion modelling

Instituto Superior Tecnico
Component reliability model

University of Newcastle
Structural analysis

Shipbuilders and Shiprepairers Association
Link to shiprepairers & Audit

TWI
System reliability & Risk analysis

SE.MA2
Link to inspection company



BUREAU
VERITAS



CONS.A.R.



UNIWERSYTET GDANSKI



INSTITUTO
SUPERIOR
TECNICO

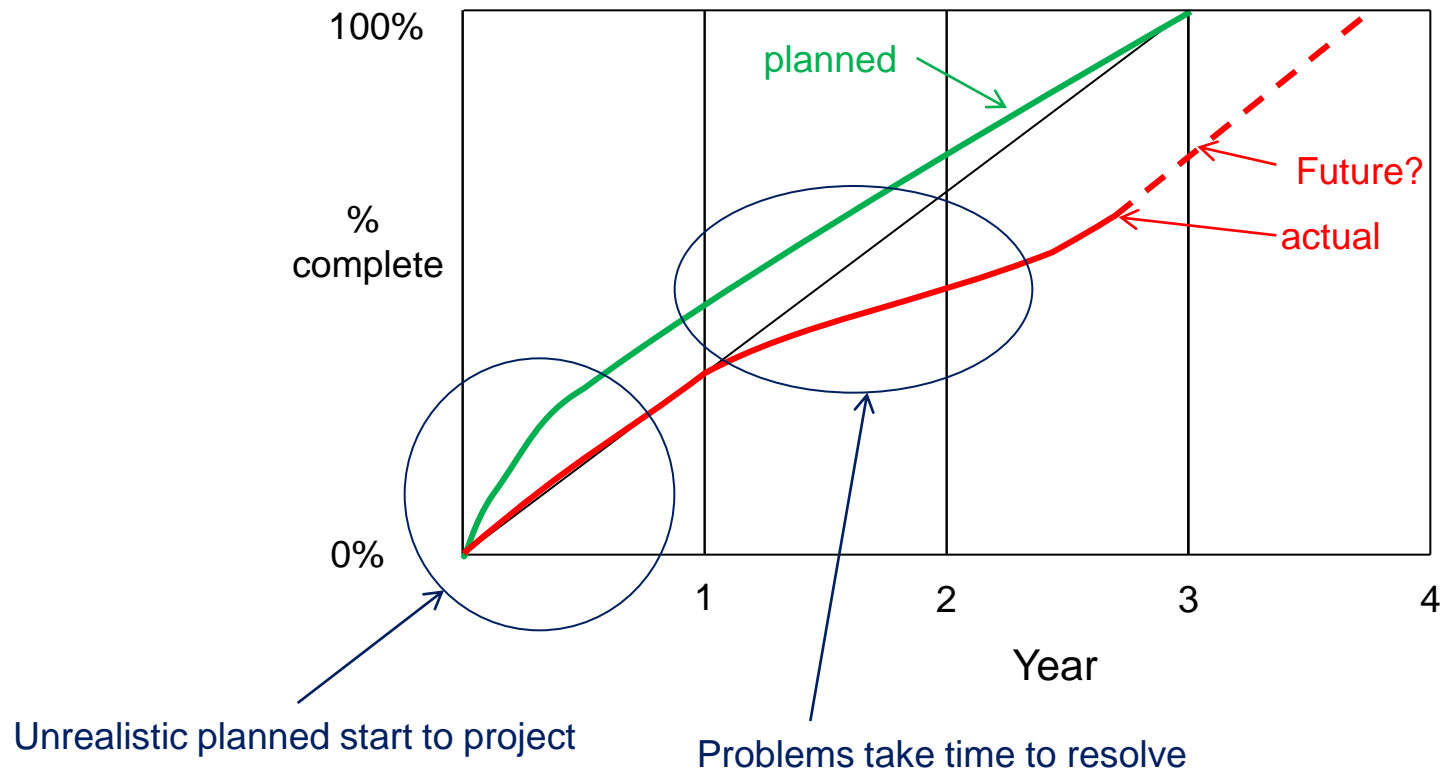


Newcastle
University

SSA Shipbuilders & Shiprepairers
Association



Project progress



Some achievements to date

- RISPECT Database structure
- Link to external hydrodynamic / structural analysis software
- Efficient models for stresses and crack growth in connections with sharp corners
- Ship structure system-reliability accounting for important correlation effects
- Interfacing RISPECT with existing class HCM model
- Interfacing RISPECT with inspection company data
- Statistical method for making best use of inspection data

Still to do (includes)

- Assemble the whole RISPECT system
- Write reporting software
- Test the system
- Run example cases

What has been learnt

1. It is difficult to fully understand the required extent of the work at the proposal stage when no one person has full knowledge of all the existing software that is to be extended and integrated.
2. Ideally we should have spent more time understanding 1. at the proposal stage, or have had a two stage project but
 1. project proposals already require a lot of time to develop.
 2. A two stage project would not fit the EU FP7 model
3. Probably need to be optimistic to get the project – proposal will not impress the EC if there is a large contingency for uncertainties
4. There is more flexibility with projects that output individual reports but the challenge of producing something where all partners' work has to dovetail together is worthwhile.

Future

Need to use the system:

Ideally needs a project to gather and analyse RISPECT data gathering and assessments prior to practical use

End