Lightweight construction applications at sea

Presentation at the LASS-conference 071031

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Fire Technology

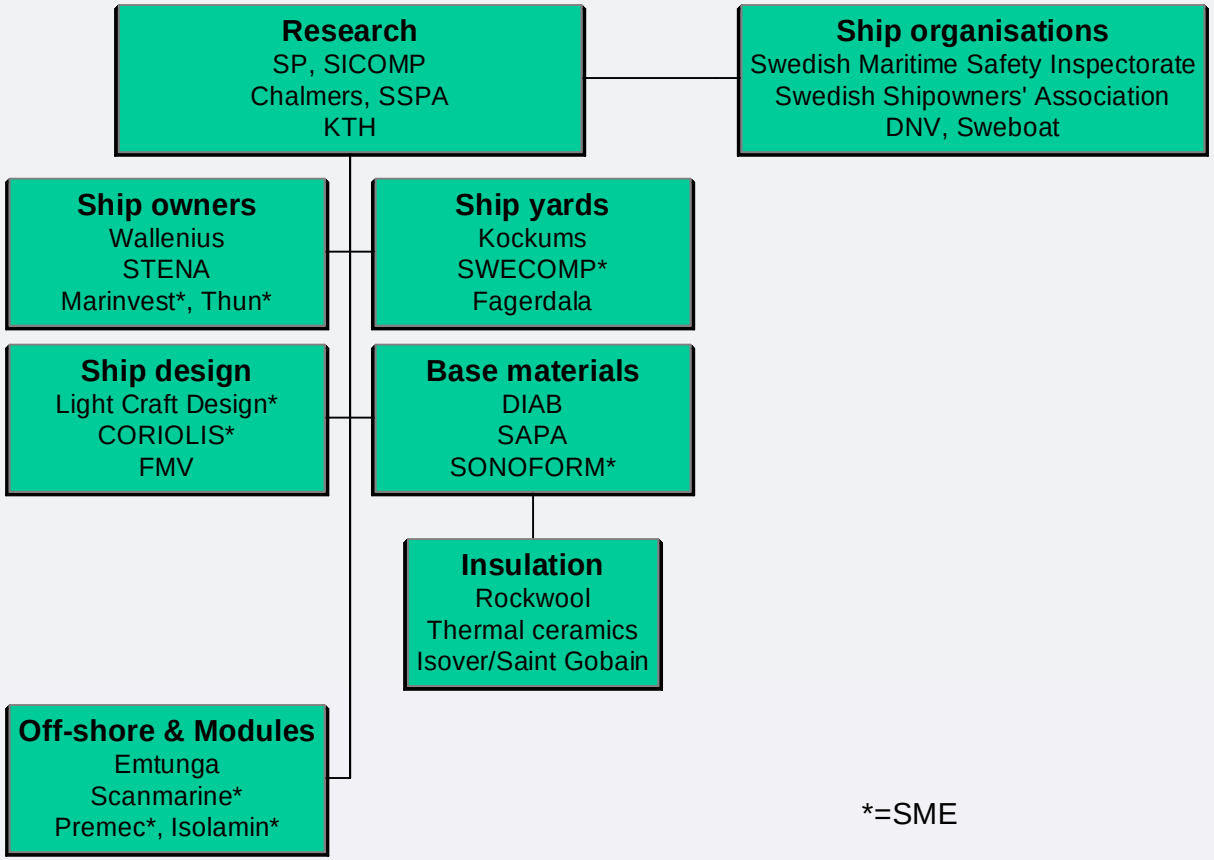
The LASS project

3.5 year (2005-2008) Swedish ~2.6 M€ project aiming at demonstrating techniques for using lightweight construction materials at sea

Financial support by VINNOVA (Swedish Governmental Agency for Innovation Systems) and participating industries

LASS members
20 original+9 associated

Participants



*=SME

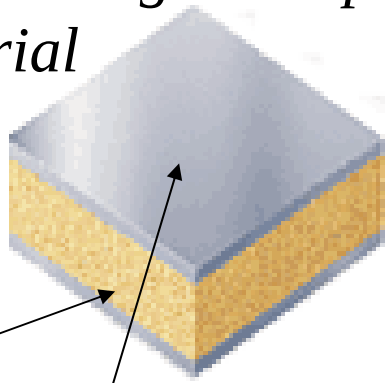
LASS project targets:

- Design of 4 (6) lightweight objects
- Demonstration of technical solutions for 30% lighter objects at 25% lower total cost
- Demonstration of practical methodologies for using light-weight constructions at sea

Lightweight materials used

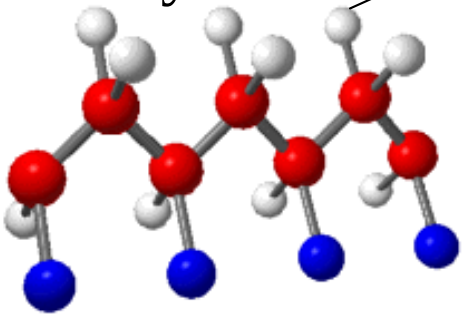
Shapable aluminium

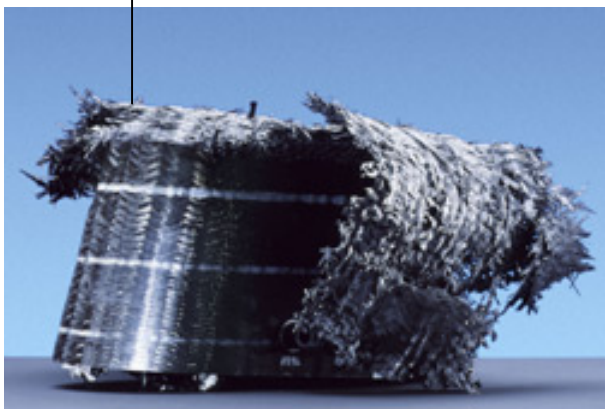
High-strength composite material



Core material

Polymer





Fibre

Advantages of light-weight at sea

- **Economical advantages**
  - Dead load ⟶ paying load
  - Less maintenance and fuel cost
- **Ecological advantages**
  - Less fuel/load
  - Environmentally friendly waste-treatment
- **Stability advantages**
  - E.g. increased stability using lightweight superstructure

Main obstacles for lightweight constructions at sea

- Technical
  - Solvable. Largest problem is fire safety.
- Tradition
  - Traditions and IMO-regulations+classification rules based on steel hinders light-weight material.
- Cost
  - Initial cost is higher. LCA/LCC neccesary for argumentation

LASS objects for study, 1-4

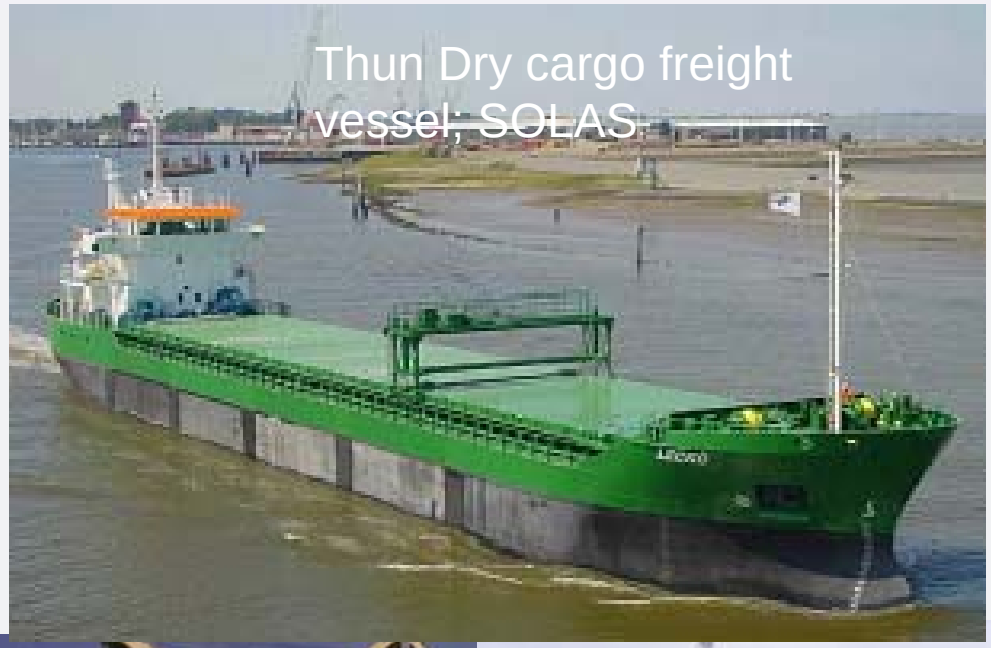
Wallenius
Ro-ro;
SOLAS

STENA High-speed
catamaran; HSC

FMV
Passenger
vessel; HSC

STENA
Ro-pax;
SOLAS

LASS objects for study, 5-6



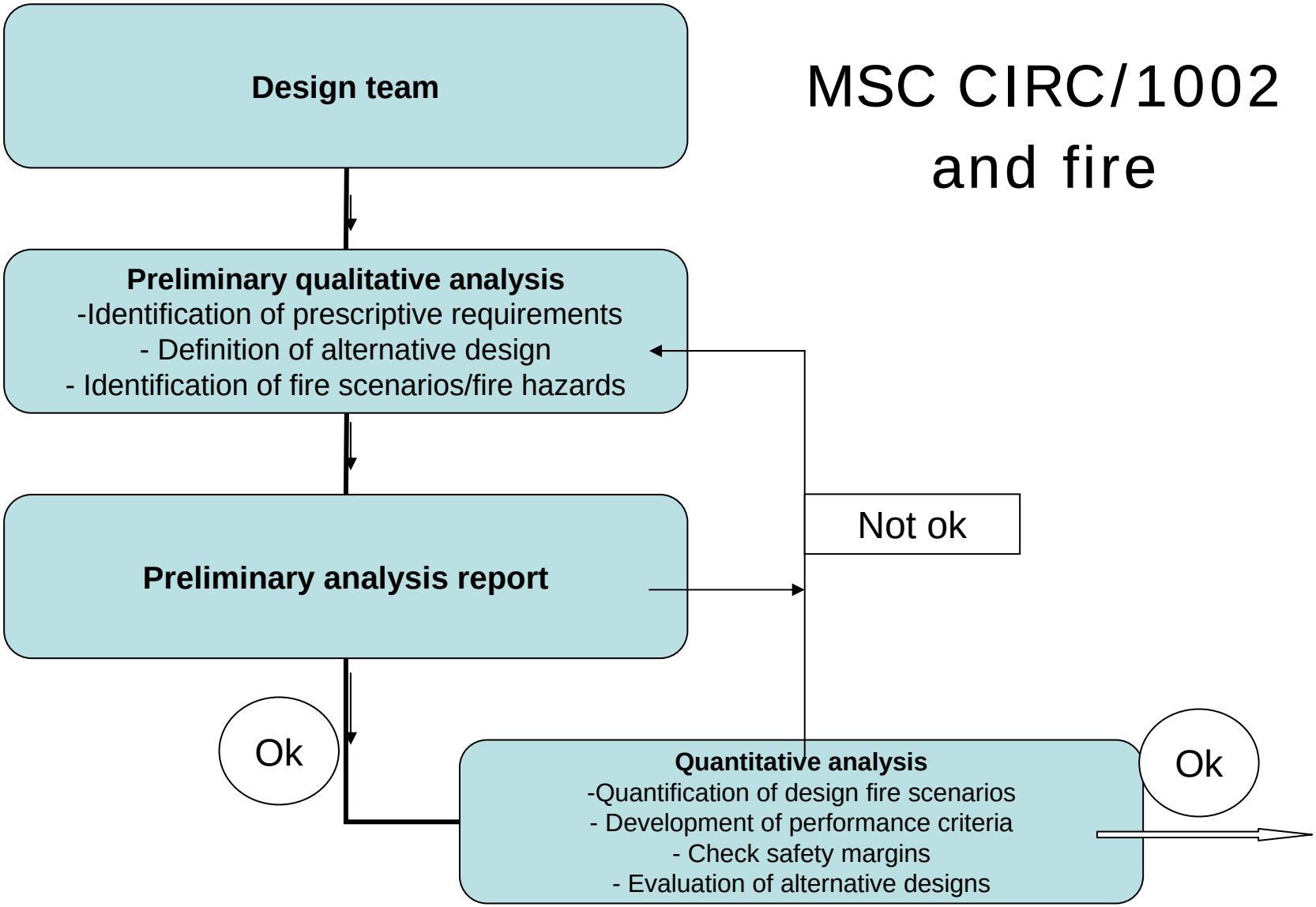
Thun Dry cargo freight vessel; SOLAS

Emtunga Offshore LQ; MODU-code, NORSOK

Fire-hazard management at sea
SOLAS, Chapter II-2

- Part A – General
- Part B - Prevention of fire and explosion
- Part C – Suppression of fire
- Part D – Escape
- Part E – Operational requirement
- Part F – Alternative design and arrangement
- Part G – Special requirements

MSC CIRC/1002 and fire



Philosophies for part F application

- *”Total anarchy”*
  - ~~FTP~~
  - Active fire protection, trained staff, ...

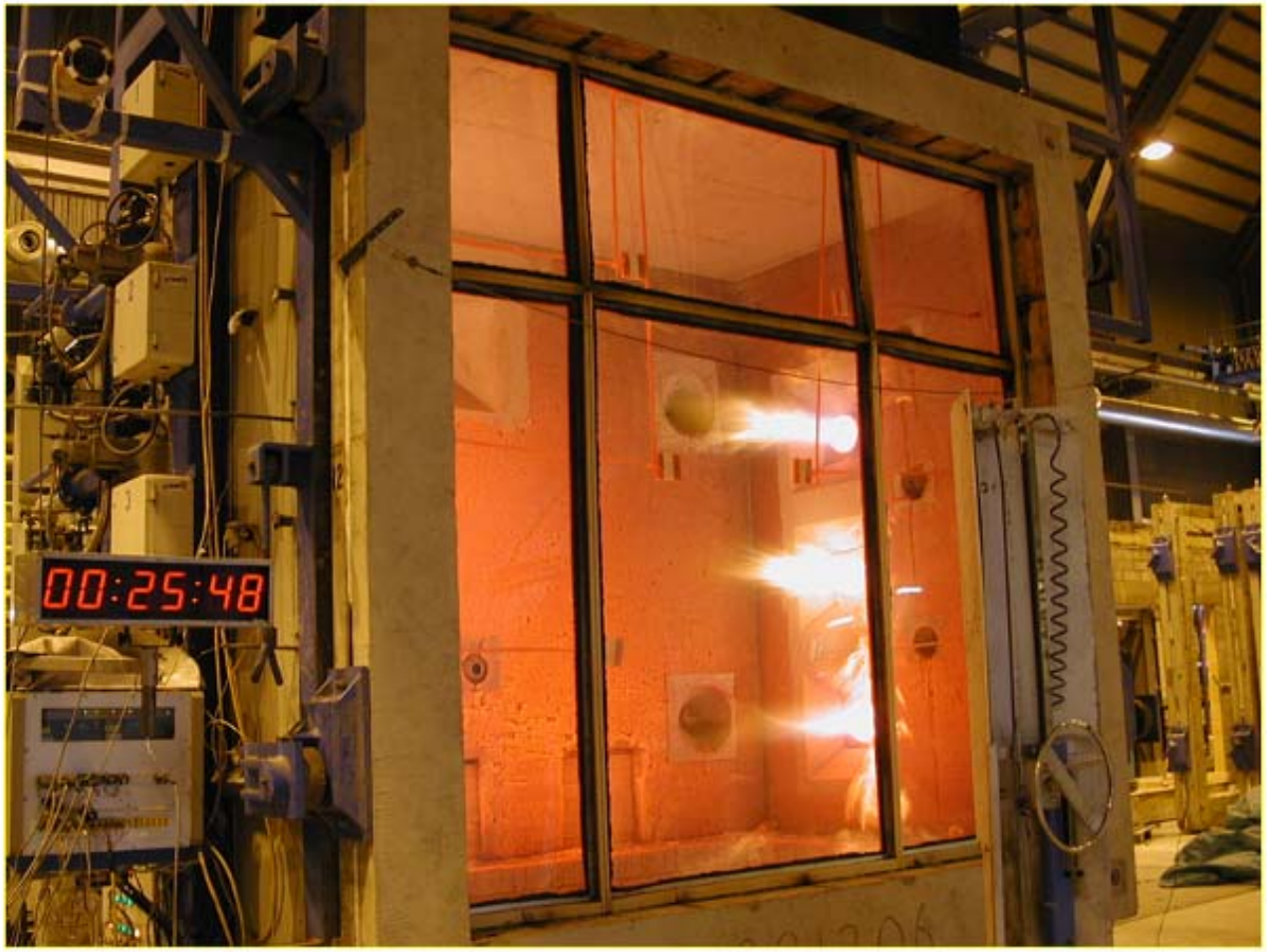
  or
- Follow prescriptive regulation and FTP as closely as possible

LASS fire safety philosophy:

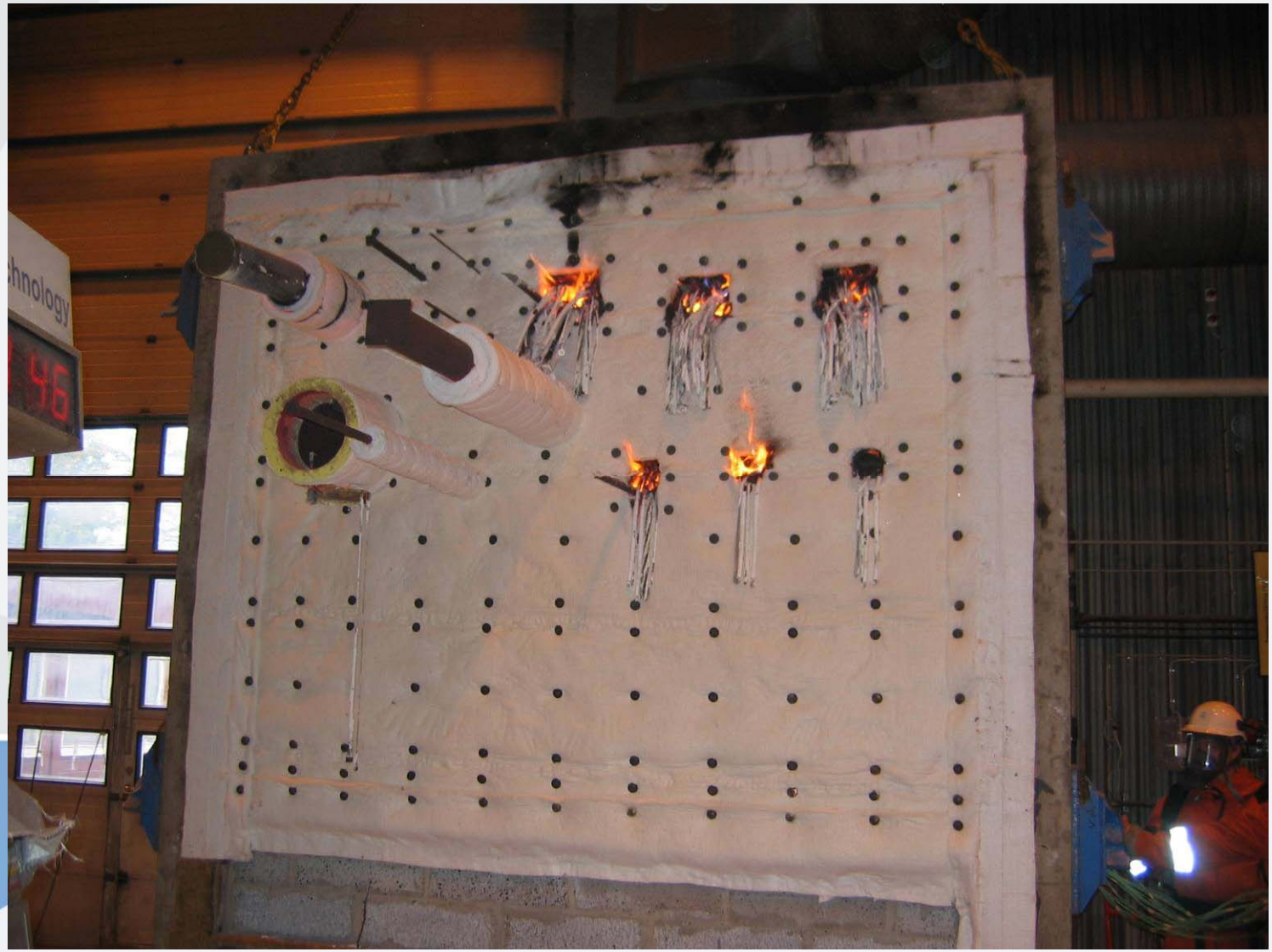
Fulfil all functional construction requirements using HSC-defined elements

Steel or equivalent	Composites	Test proceedure
A-class division	Fire resisting division 60	A.754(18) — MSC.45(65)
B-class division	Fire resisting division 30	A.754(18) — MSC.45(65)
C-class division	Fire restricting material	ISO 1182 — MSC.40(60) (Room-Corner)

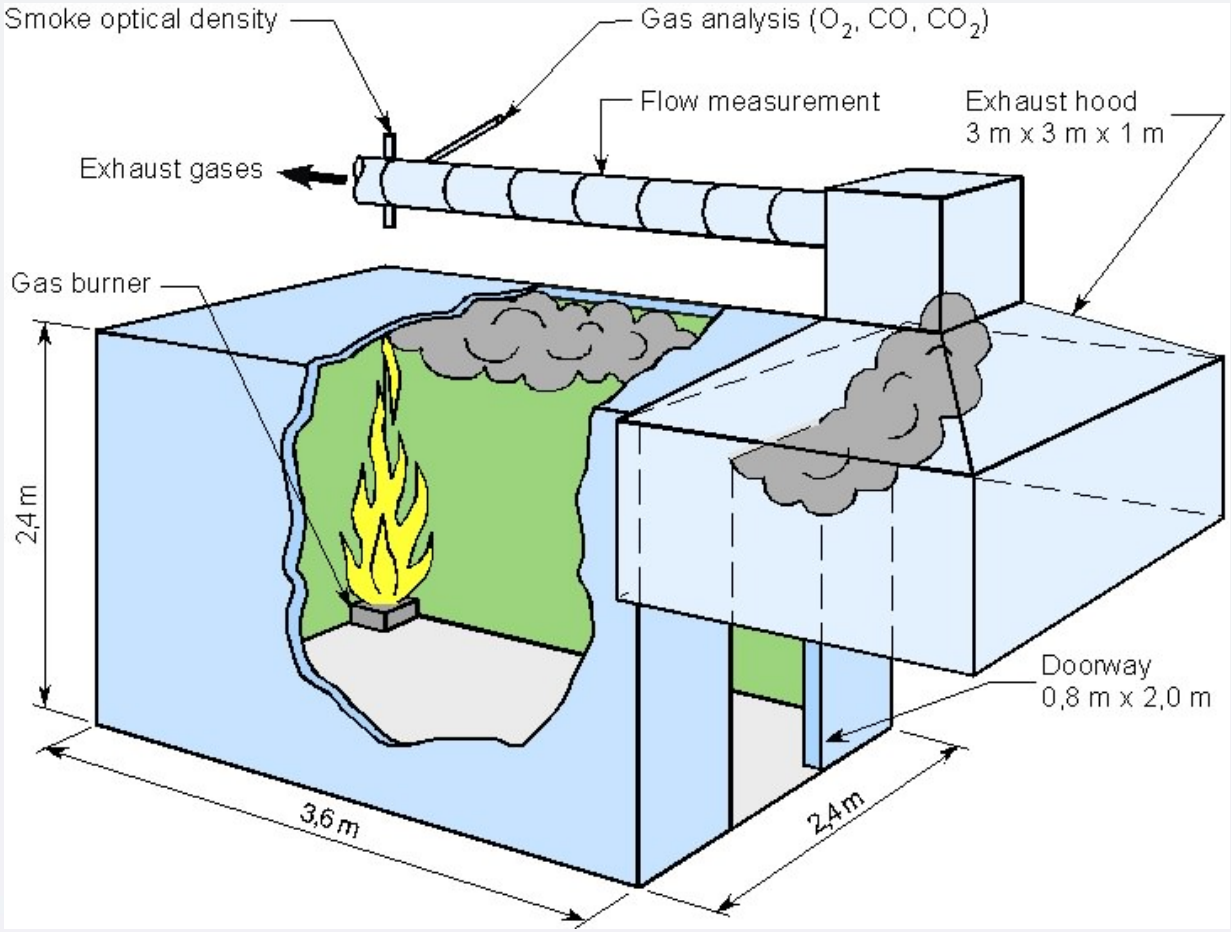
Fire tests; large scale (A.754, MSC 45(65))



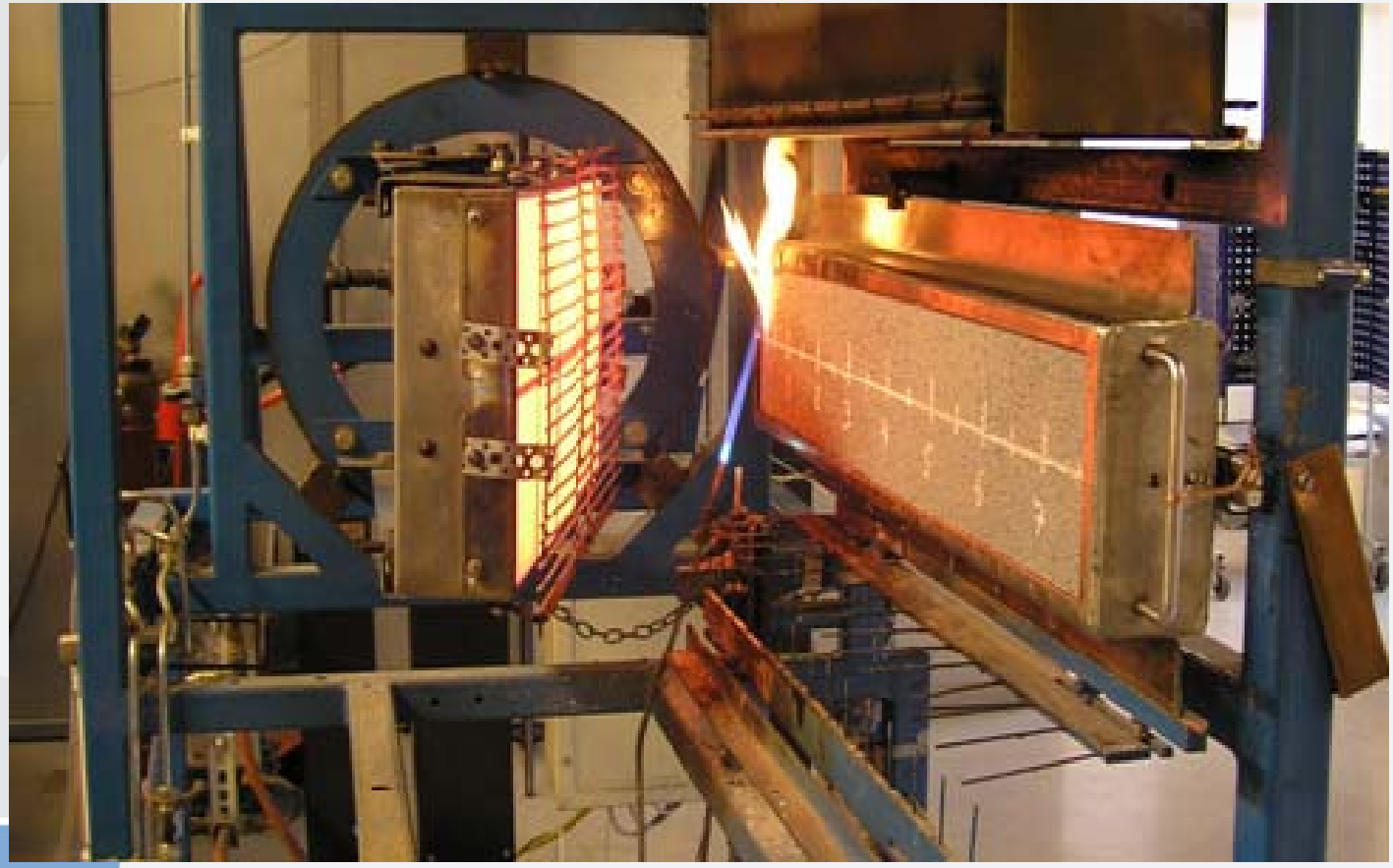
Successful composite bulkhead penetration test



Fire restricting material: Room-corner



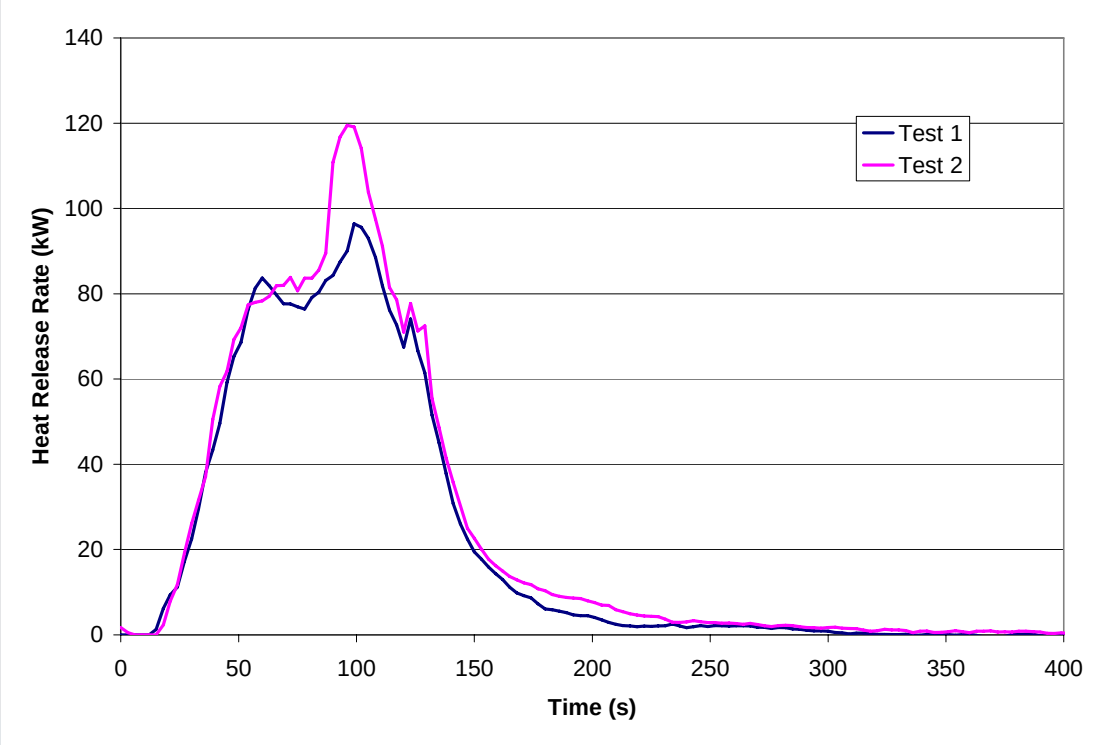
Fire tests; small scale



External composite fire: KNM Orkla

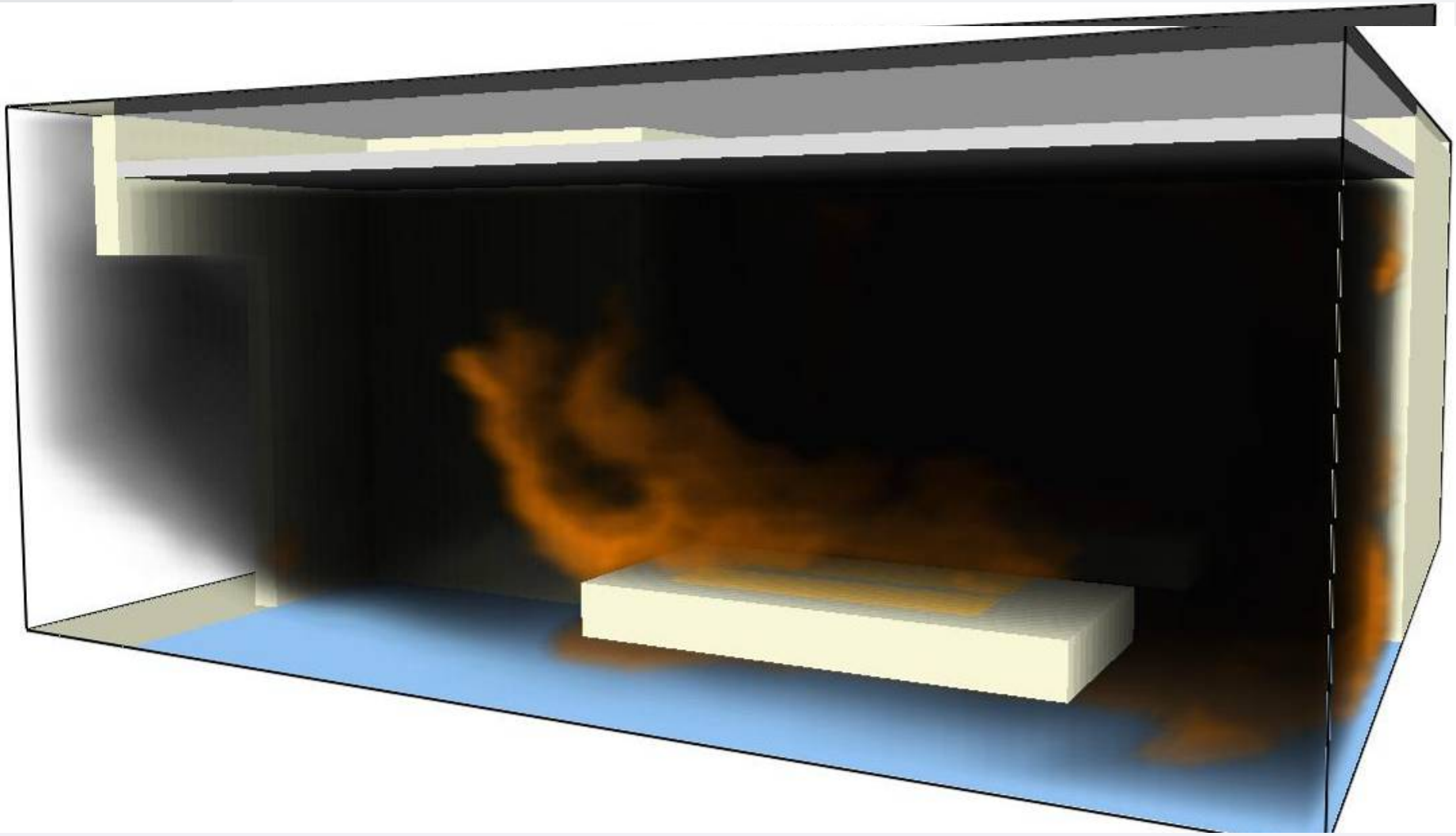
Test data for fire simulations

(data base www.sp.se/fire/fdb)



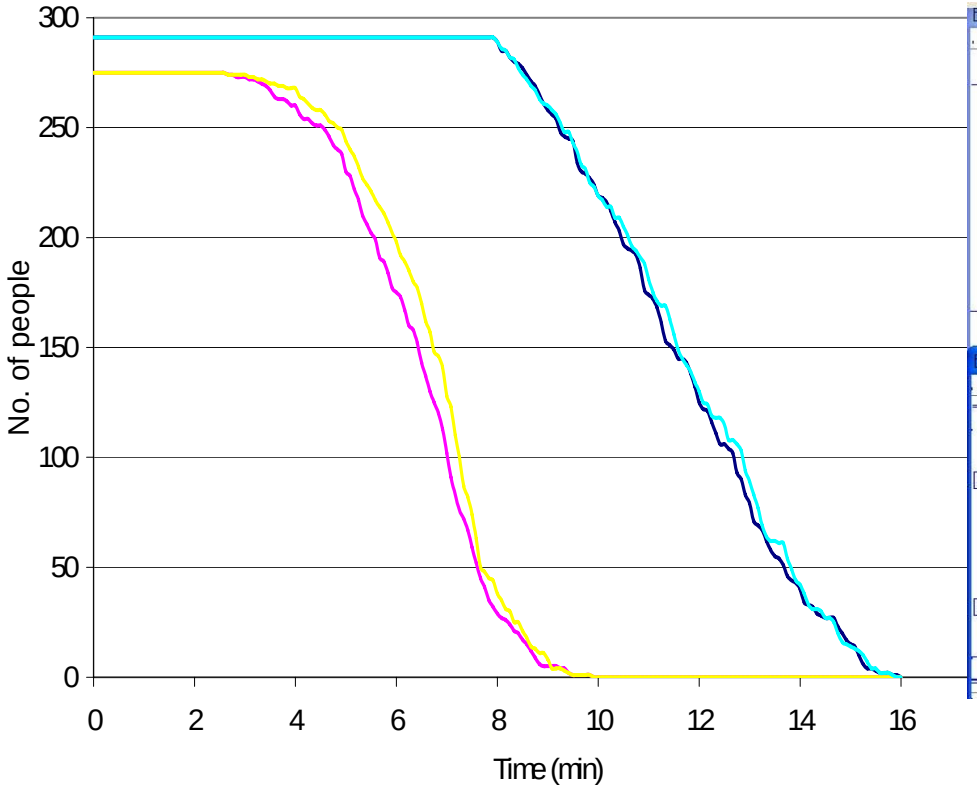
CFD-fire simulation

FDS-simulation

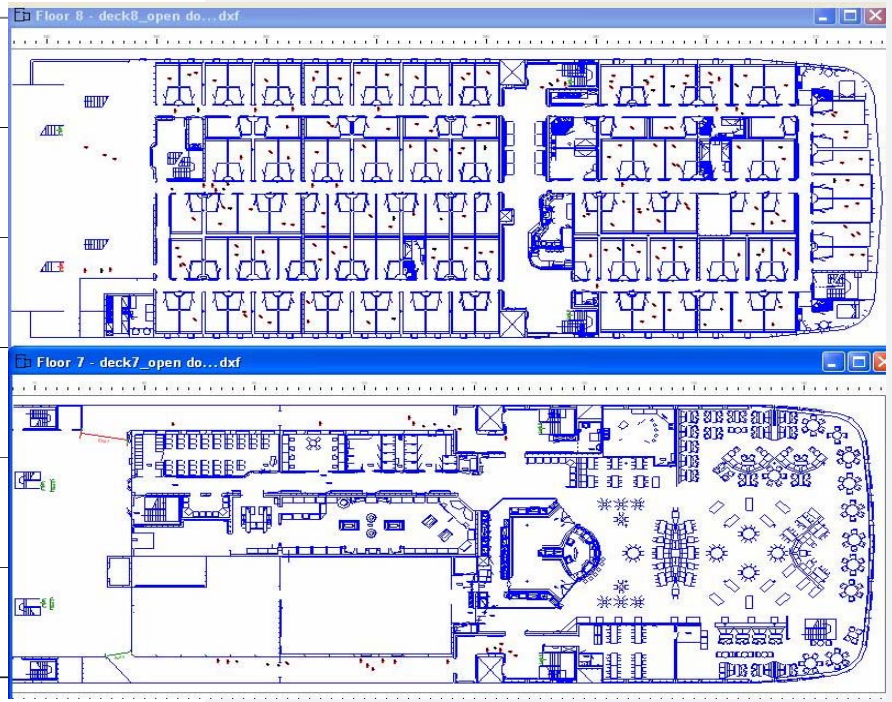


Egress simulations

No. of people that has *not* reached the assembly station



Simulex-simulation



Fire risk analysis

(by courtesy of Dag Mcgeorge, DNV)

certified composite constructions

- **Thermal Ceramics**
  - FRD 60 deck and bulkhead, 100 mm, 6.85 kg/m^2
  - Fire restricting material, 20-25 mm, 0.96-1.5 kg/m^2
- **Isover / Saint-Gobain**
  - FRD 60 deck and bulkhead, 100 mm, 7.5 kg/m^2
  - FRD 30 bulkhead, 75 mm, 5.4 kg/m^2
  - Fire restricting material, 3.3 kg/m^2
- **MCTBrattberg + Thermal Ceramics (LASS / SAFEDOR)**
  - FRD 60 penetration constructions, deck and bulkhead
- **Lightweight primary deck covering (LASS / SAFEDOR)**
- **Planned:**
  - Thermal ceramics: FRD 60 bulkhead test of high temp core + phenolics
  - Isolamin + Isover: B-class lightweight panel tests
  - Hellbergs Int: FRD 60 test, door in composite construction
  - Norac + Isover: FRD 60 window tests

Weight reductions obtained within LASS

OBJECT	***ORIGINAL MATERIAL***	***NEW MATERIAL***	**WEIGHT REDUCTION**
Wholly composite HSC	Aluminium	GRP-sandwich	28 %
Wholly composite HSC	Aluminium	CRP-sandwich	44 %
Superstructure on HSC	Aluminium	GRP sandwich	6 %
Superstructure on HSC	Aluminium	CRP sandwich	28 %
Upper decks on ro-ro	Steel	Aluminium	45 %
Upper decks on ro-ro, optimised	Steel	Aluminium	65-70 %
Superstructure on ro-pax	Steel	GRP-sandwich	63 %
Superstructure, etc on freight vessel	Steel	GRP-sandwich	> 50 %
Offshore LQ	Steel	Aluminium	>30 %

Cost/LCC

- Composite HSC < aluminium HSC
- Payback time for ro-pax ~ 2 years
- Payback time for ro-ro vessel < 5 years

LASS: work in progress

- Support for commercial ship building projects:
  - Stena ro-pax with composite superstructure
  - Swedish cost guard patrol vessels in composite
- Large-scale cabin-corridoor fire tests
- Development of EU-project co-operations (SAFEDOR, De-Light Transport, SURSHIP)
- Information exchange with other research projects
- Marketing of know-how

Further information at project website:

www.lass.nu

Thank you for your attention!