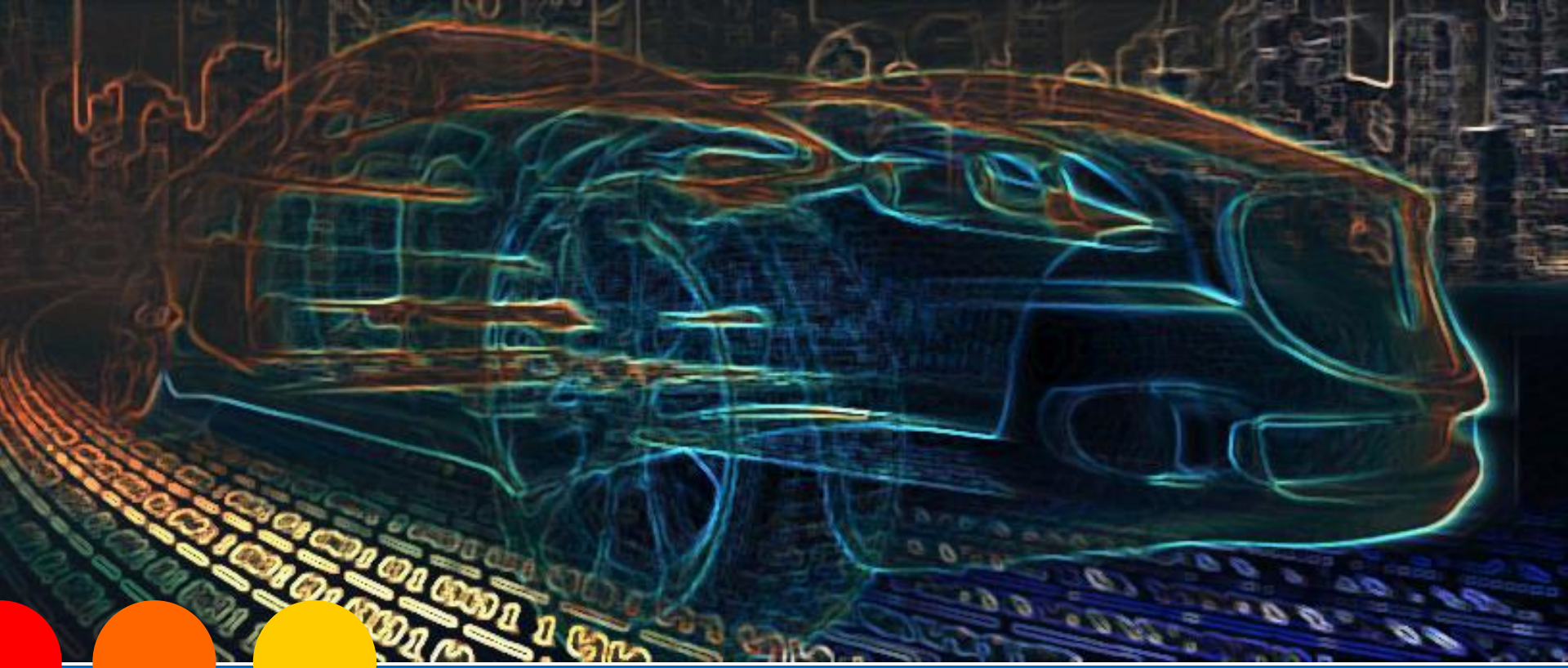

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Analysis of other transport modes : Maritime sector

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Philosophy of fire safety in maritime

- Compartmentalization is essential in case of fire
- Each room is rated according to potential risks.
- The partitioning and required tests depend on this rating.
- Active and passive systems are used together.
- Many rooms are sprinkled (cabins) or under water mists (machine rooms).
- For fast ships and for lifeboats, additional requirements may apply.

Fire safety in the maritime field

- Fire safety in the maritime field has been established by IMO since 1948. It depends on the United Nations and has 166 member states.

- The IMO Fire Protection Subcommittee meets every year to discuss the applicable tests and requirements described in the FTP code.

- IMO (International Maritime Organisation)

- MSC (Maritime Safety Committee) → SOLAS (Safety Of Life At Sea) Convention

- Fire Protection Subcommittee → FTP (Fire Test Procedures) code

SOLAS Convention : Safety of Life at Sea

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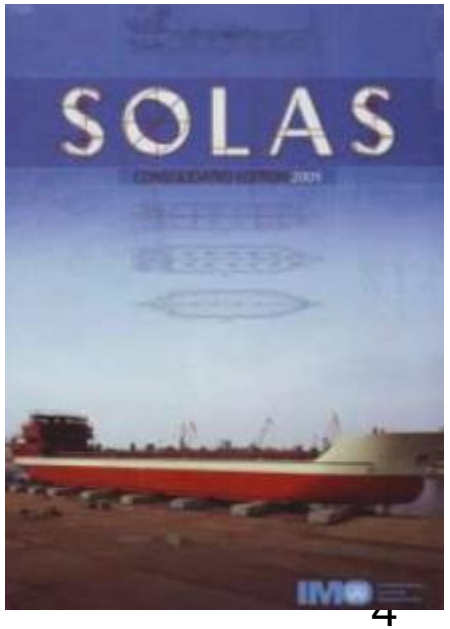
Chapter II-2 - Construction – Prevention, detection and fire extinction

Sets construction and intervention rules (7 parts, 20 rules)

- Rule 17 : Alternative designs and arrangements:
  - Method described in MSC/circ.1002: use of ISO documents
  - Allows performance-based approach and equivalence to a traditional reference solution

- FTP code (Fire Tests Procedures)
- FSS code – Fire safety systems



Structure of FTP code 2010 (MSC88-26)

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- Part 1 : Non-combustibility test
- Part 2 : Smoke and toxicity test
- Part 3 : Test for A, B and F class fire division
- Part 4 : Test for Fire door control systems
- Part 5 : Surface flammability test
- Part 6 : reserved
- Part 7 : Tests for vertically supported textiles and films
- Part 8 : Tests for upholstered furniture
- Part 9 : Tests for bedding components
- Part 10 : Test for Fire-restricting materials for high-speed craft
- Part 11 : Tests for Fire-resisting divisions of High-speed craft

In red: chapter related to "reaction to fire"

Reaction to fire tests

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FTP code	Type of test	Reference	Comments
Part 1 : Non-combustibility test	non combustability	ISO 1182	similar to building products
Part 2 : Smoke and toxicity test	NBS smoke chamber + FTIR	ISO 5659-2	thresholds next page
Part 5 : Surface flammability test	LIFT, IMO flame spread	ISO 5658-2	flame spread distance vs time, flame front velocity vs heat flux, critical heat flux and the average heat for sustained burning
Part 7 : Tests for vertically supported textiles and films	Small flame tests on vertical holder	A.687(17) + A.563(14)	
Part 8 : Tests for upholstered furniture		A.652(16)	
Part 9 : Tests for bedding components	Cigarette & match test	A.688(17)	
Part 10 : Test for Fire-restricting materials for high-speed craft	Cone calorimeter	ISO 5660-1	small scale
	Room corner test	ISO9705	intermediate scale

Threshold values

FTP code	Type of test	Reference
Part 2 : Smoke and toxicity test	NBS smoke chamber + FTIR	ISO 5659-2

- The maximum optical density of smoke (Dm) is measured and calculated (in ppm) and averaged over 3 tests:
  - Dm < 200 ppm for materials used for the surfaces of partitions, ceilings and decks
  - Dm < 400 ppm for materials used as undercoat constituting deck coatings
  - Dm < 400 ppm for plastic pipes and electrical cables
- Smoke toxicity

Species	Critical values in ppm
CO	1450
HCl	600
HF	600
Nox	350
SO2	120
HCN	140
HBr	600

Conclusion

- Philosophy in the naval sector in case of a fire is compartmentalization of affected area in order to maintain continuity of operation until the ship can safely dock.

- Fire safety regulation is governed by IMO and technical details are found in Fire Tests Procedures (FTP) code and FSS code – Fire safety systems

- Regarding reaction to fire tests (flammability, toxicity…): A mix of IMO standards and ISO standard tests are in use with specific requirements. (no justifications were found behind these requirements)

- Finally, rule 17 of Chapter II-2 of SOLAS convention allows use of fire safety engineering (performance-based approach) to justify alternative /innovative solutions if they are proved to be safe.