New Fire Strategies in the Wake of Umoe Ventus

Annex B – Internal workshop

DBI FIRE AND SECURITY

OSK-ShipTech A/S

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1 Introduction

1.1 Scope and agenda

The workshop took place on May 22nd, 2017 at DBI's office in Fredericia. The list of participants is given in Table 1.

The objective of the workshop was to bring together the project team with external participant from the maritime industry, involved in companies operating ships built with composite materials and discuss the operation of these types of ships, their challenges, and their risks.

In the first part of the meeting, the background study (Appendix A) was presented, followed by a discussion around the safety principles of the High Speed Craft (HSC) Code. The second part of the meeting was an exchange of impressions with the external participants on the impact composite materials have on safety of on board HSC vessels. The third part of the workshop was an identification of the risk areas, potential sources of ignition, and primary fuel sources commonly present on board HSC vessels built with composite materials. The analysis of steel designs is out of the scope of this project.

No specific conclusion of the work produced during the workshop will be put forward. The value of the workshop lays in the results obtained, which will serve as input/foundation to the work on the fire scenarios.

Table 1 – List of workshop participants

Name	Company	Role in workshop	Professional occupation
Anders Dragsted	DBI	Project team member	Project manager
Konrad Wilkens	DBI	Project team member	Research consultant (engineer)
Thomas Hulin	DBI	Project team member	Research consultant (engineer)
Kristoffer Jensen	OSK ShipTech	Project team member	Naval architect
Billy T. Kristensen	Offshore Windservice A/S	External participant	Superintendent
Tomas Valling	Valling Ship Management ApS	External participant	Director / Naval Architect B. Sc.

1.2 Objectives

The workshop had for objectives to:

- Gather input from professionals of the field
- Identify risks present on board composite vessels

2 Summary of workshop results

The technical drawing with room layout of the HSC vessel Fob Swath 4 (last page in this appendix) was used to help the analysis of a HSC vessel and identify risk areas, sources of ignition, and primary fuel sources. The analysis highlighted the ranking of areas present on board a HSC vessel, the potential ignition sources (Table 2), and primary fuel sources (Table 3).

2.1 Area ranking

The workshop participants agreed on the following ranking for areas commonly found on board a HSC vessel. They are presented below from the most important to the least important.

- Bridge
- Engine room
- Switchboard room
- Pump room
- Galley/kitchen
- Casing
- Void spaces

When talking about "importance", the term has to be taken relatively. It concerns the perception of the degree of importance each room holds, as formulated by the various stakeholders represented by the workshop participants. The ranking has no absolute value, does not represent a scientific truth, but correlates to a certain degree to the classification of spaces put forward by the HSC Code.

It should be noted that the void spaces come last in terms of perception of importance. In the HSC Code they are treated as areas of minor or no fire risk. As highlighted in the background study (Appendix A), their status on board vessels built with composite materials should be changed, which would require extensive work on the perception they receive in the industry.

The bridge remains perceived as the most important area, since all controls are located there. On a fire perspective, the bridge is not considered as the most risky area.

All rooms containing systems vital to the operation of the ship come after the bridge in terms of importance. Most of them also represent areas of moderate to high fire risk according to the HSC Code, therefore their risk perception can be considered logical.

2.2 Ignition sources

A systematic room-to-room analysis of a HSC vessel led to the identification of the ignition sources presented in Table 2. The number of appearances is a total over the full vessel layout.

It should be noted that the source of ignition appearing the most frequently is a hot surface. In the case of the engine room, hot surfaces are easily found and can ignite e.g. a liquid fuel. Such a situation can occur in both steel and composite designs. However, the case of a hot pipe penetrating e.g. a void space is not a relevant ignition source for a steel design, but becomes of primary concern for a composite design as the hot pipe can ignite a composite bulkhead (cf. accidents documented in the background study, Appendix A).

Hot surfaces are then the expected major source of ignition for composite designs, but are not considered in the HSC Code as elements which should be protected against. This analysis highlights one more specificity of composite designs with respect to fire risks, and has been developed as well in the technical analysis presented in Appendix D. One of the main improvements to fire scenarios is to consider the direct contact of composite materials and hot surfaces as a source of ignition.

Table 2 – Sources of ignition commonly found in a HSC vessel built with composite materials

Ignition source	Number of appearances	Ranking
Hot surface	6	1
Electrical equipment	5	2
Batteries	3	3
Exhaust	3	3
Electrical kitchen equipment	1	4
Hot oil	1	4
Gas equipment	1	4
Oil heater/boiler	1	4
Flammable gases	1	4

The other ignition sources are rather traditional, and appear in the HSC Code in the definition of space categories.

2.3 Primary fuel sources

The same type of analysis as carried out for the ignition sources help identifying the primary fuel sources. A summary is presented in Table 3.

It can be observed that the primary fuel source appearing most frequently is a composite component, before interior components (which can also be made of composite materials for weight savings). The very structure of the vessel then becomes a fuel source. This observation correlates with accident reports and unfolding of actual fire events on board vessels built with composite materials. There is therefore a critical need to protect the composite components from getting involved in a potential fire, particularly those making up the structure of the vessel. Protection can be provided to some extent to components located inside the vessel. Components located outside (e.g. hull) represent a challenge. One of the main improvements to fire scenarios is to consider an element like the hull as the primary fuel source for vessels built with composite materials.

Table 3 – Primary fuel sources commonly found in a HSC vessel built with composite materials

Fuel source	Number of appearances	Ranking
Composite components	5	1
Interior components	4	2
Oils	3	3
Liquid fuels	3	3
Plastics	2	4
Stored flammable liquids	2	4
Rags	2	4
Fat/grease (incl. in vent ducts)	1	5
Dust	1	5
Flammable gases	1	5
Rubbish (e.g. kitchen)	1	5

3 Conclusion

As a conclusion to the workshop, it can be stated that:

- Knowledge of the properties of composite materials, particularly in fire, can and should be improved in the industry

- Perception of the importance of an area does generally correlate with the actual risk this area represents

- Void spaces are considered as areas of low or no fire risk, and the change of their status when building with composite materials comes as a surprise to stakeholders

- Fire scenarios for vessels built with composite materials can be improved by considering hot surfaces as sources of ignition (when they are disregarded by the HSC Code, based on the properties of steel)

- Fire scenarios for vessels built with composite materials can be improved by considering the building material as a source of primary fuel

Generic Vessel Areas

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Reference group workshop
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Bridge
- Ignition sources
    - Electrical equipment
    - Hot surfaces
    - Batteries

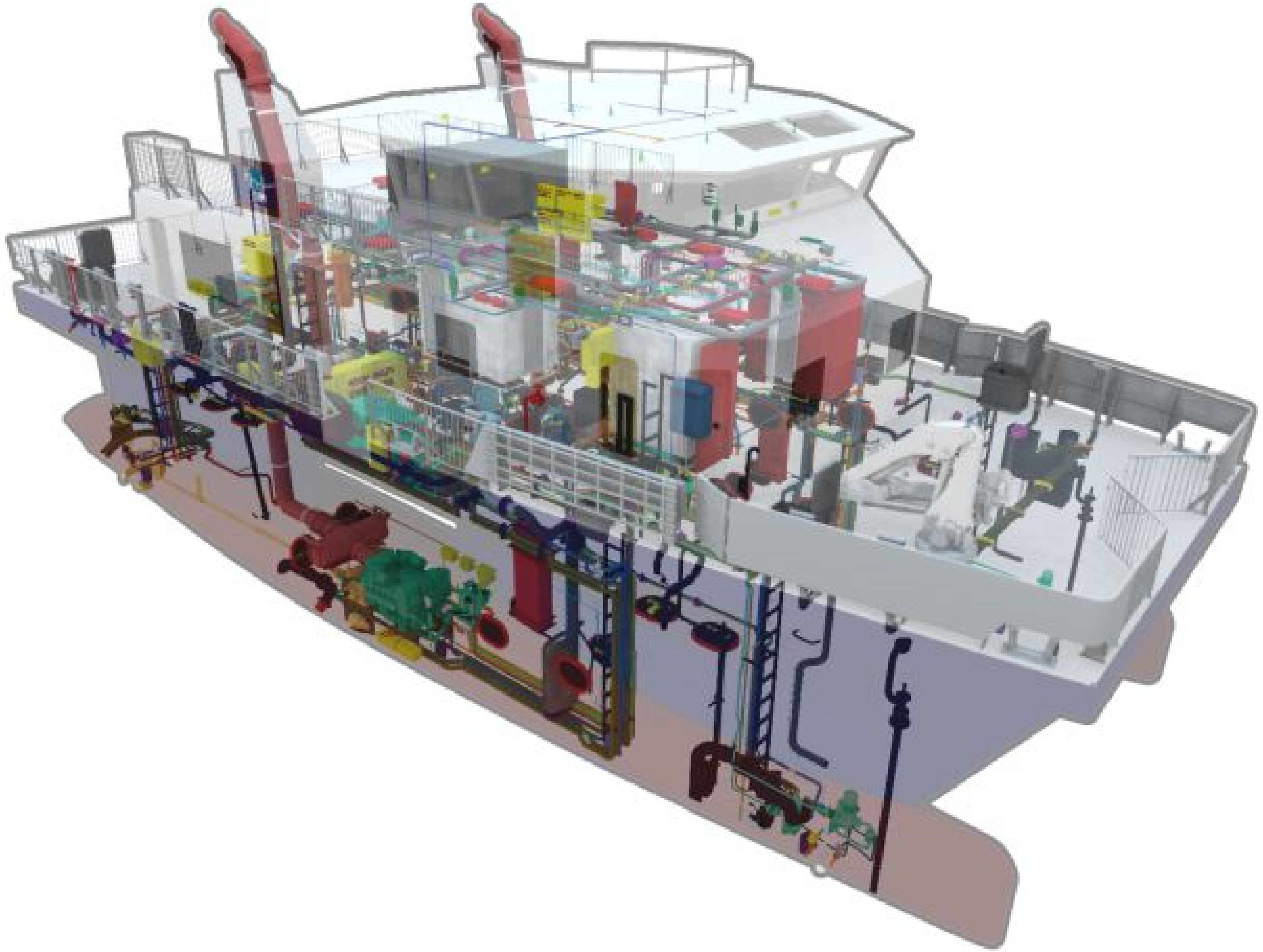
- Fuel sources
    - Interior components
    - Composite components
    - Plastics

Pantry / Galley
- Ignition sources
    - Electrical kitchen equipment
    - Hot oil
    - Gas equipment
    - Hot surfaces
    - Ventilation ducts

- Fuel sources
    - Hot oil
    - Grease in vent. ducts
    - Interior components

Eng. room / Aux. eng room
- Ignition sources
    - Electrical equipment
    - Hot surfaces
    - Oil heater / boiler
    - Exhaust
    - Batteries

- Fuel sources
    - Liquid fuels
    - Stored liquid fuels
    - Rags
    - Structural composite
    - Combustible cabinets
    - Oil spills



Switch Board Room
- Ignition sources
    - Electrical equipment
    - Hot surfaces
    - Batteries

- Fuel sources
    - Plastic parts
    - Dust
    - Liquid fuels

Casing
- Ignition sources
    - Exhaust
    - Hot surfaces
    - Flammable gases

- Fuel sources
    - Structural composite

Pump Room
- Ignition sources
    - Electrical equipment
    - Mechanical friction heat

- Fuel sources
    - (As eng. room)

Void Spaces
Distinguish voids categories:
A- Empty space
B- Spaces with cables and ducts passing through
C- Space with equipment