International Chamber of Shipping
Shaping the Future of Shipping

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18 July 2024 **CE(24)08**

TO: CONSTRUCTION AND EQUIPMENT SUB-COMMITTEE

COPY: MARINE COMMITTEE
CONTAINER AND DANGEROUS GOODS PANEL

DRAFT AGENDA AND NOTES FOR THE AD-HOC MEETING ON CONTAINER FIRES - DISCUSSION ON THE OUTCOMES OF 'CARGOSAFE' RESEARCH & OTHER SUBMISSIONS TO BE HELD ON TUESDAY – 20 AUGUST 2024

Action required: ***Members are invited to review and circulate within their respective Member companies, the draft agenda notes (within this circular) for the ad-hoc meeting on container fires to be held on Tuesday, 20 August 2024, commencing at 10.00 am UK time. Members and their respective Member container shipping companies, who have not registered their participation are encouraged to register for the meeting.***

Members are invited to review the draft agenda notes for the forthcoming meeting on container fires - discussion on the outcomes of 'CARGOSAFE' research & other submissions, and notify the undersigned (lional.sharon@ics-shipping.org) of any additional items/changes to be brought to the attention of the participants by 19-August- 2024.

Details of the meeting are mentioned below for easy reference:

Ad-hoc meeting on container fires
Date: Tuesday, 20 August 2024
Time: 10:00 to 16:00 (BST)
Mode: Hybrid format

Members and their respective Member companies, who have not already registered their participation, can do so with emmy.ramirez@ics-shipping.org.

Lional Sharon
Secretary - Container & Dangerous Goods Panel

INTERNATIONAL CHAMBER OF SHIPPING

AD-HOC MEETING ON CONTAINER FIRES

20 August 2024 (10:00 – 16:00 BST)

Walsingham House, 35 Seething Lane, EC3N 4AH and via Teams

DRAFT AGENDA

1. **Introduction**

2. **Container fires- regulatory developments**

3. **CARGOSAFE – Background**

4. **Review of outcomes of CARGOSAFE**

5. **Any Other Business**

6. **Conclusion**

****NB: The ICS Secretariat is coordinating with presenters on various RCOs. The same shall be updated towards the commencement of the meeting.**

INTERNATIONAL CHAMBER OF SHIPPING

Ad-hoc meeting on container fires - discussion on the outcomes of 'CARGOSAFE' research & other submissions to IMO- on Tuesday 20 August 2024

DRAFT AGENDA WITH MEETING NOTES

GOVERNANCE AND COMPLIANCE

Statement of Compliance with Competition Law

ICS is firmly committed to maintaining a fair and competitive environment in international shipping. As such, it is the policy of ICS to comply fully with all applicable competition laws. ICS will endeavour to ensure that all meetings (including all committees, subcommittees and panels) will be conducted in compliance with applicable competition laws.

Declarations of Interest

ICS is committed to best practice in all aspects of corporate governance. As part of this commitment, all members of the Board of Directors and its Committees are required to exercise independent judgement in the best interests of ICS and should not be, or perceived to be, unduly influenced by external factors in their decision-making. This includes fully disclosing any actual, perceived or potential conflicts of interest. ICS asks all members of the Board of Directors and its Committees on appointment to carefully read its Conflicts of Interest Policy and identify and declare any relevant interests in line with the terms of that Policy. In addition, members are required to declare any interest which may be relevant to business on the agenda of a meeting.

Privacy Policy

ICS complies with all applicable data protection law, notably the EU General Data Protection Regulation (EU 2016/679) as implemented by the UK Data Protection Act (2018). Members' attention is drawn to the use of personal data as outlined in the ICS privacy policy which can be found on the ICS website here. Questions regarding the use of personal data should be raised directly in writing to legal@ics-shipping.org

1. **Introduction-**

The participants of the meeting are welcomed by the Chair & Secretariat.

The participants may be asked to introduce themselves.

Chair shall explain the purpose of the meeting and introduce the presenters

The Secretariat shall update the participants with the housekeeping things and any other arrangements.

Abbreviations & definitions:

<u>CARGOSAFE related</u>

CARGOSAFE- Study investigating cost-efficient measures for reducing the risk of cargo fires on container vessels

***CSZ*- Container Spacing zone:** Above deck space on container ships that extend beyond the lashing bridge

***EMSA*- European Marine Safety Agency**

***FSA*- Formal Safety Assessment:** A pre-regulatory holistic assessment process developed by IMO and standardised by MSC-MEPC.2/Circ.12/Rev.2- "Revised guidelines for formal safety assessment (FSA) for use in the IMO rule-making process". It includes,

- identification of hazards
- risk analysis
- risk control options
- cost-benefit assessment and
- recommendations for decision-making.

***HAZID*- Hazard Identification:** Four sessions of hazard identification (HAZID) workshops were conducted online as teak-1 of this project. The 4 sessions covered – detection, containment, firefighting, prevention aspects of container fires.

***LBZ*- Lashing bridge zone:** Above deck space on container ships that is between the lowest tier on deck to the top of the lashing bridge.

***RCO*- Risk Control Option:** RCOs are the measures (incl. procedures, technologies, innovations etc.) that can be implemented to control the fire risk.

Gathering input from the HAZID workshops, several risk control measures (RCMs) were taken into consideration for choosing the viable RCOs. The chosen RCOs were classified into fire prevention, fire detection, firefighting, and fire containment. The effectiveness of each RCO was then evaluated in terms of risk reduction potential and technology readiness level (TRL). Based on this assessment, the realistic RCOs were selected and considered for the cost-effectiveness assessment (CEA).

***TRL*- Technology Readiness Level**: A ranking system where, relevant TRL of respective RCOs is assigned based on the maturity of the RCO, its availability in its current format in the market and its utility. TRL from 6 to 9 is considered more feasible.

First Mitigation Phase	Fire Prevention	Fire Detection	Fire Fighting	Fire Containment
1st RCO priority	Improved control of Lashing (TRL-7)	Portable IR cameras for crew to enhance manual detection (TRL- 9)	Methods for Unmanned firefighting (TRL- 8)	Passive protection to protect from fire spread towards the deck (TRL-8)
2nd RCO priority	Container Screening tool (TRL-6)	Heat detection- looking at individual container temperature raise (TRL- 9)	Manual Fire fighting tools to increase reach (TRL-9)	Active protection underneath hatch covers to protect from fire spread towards the deck (TRL-9)

IMO related

CCC- Sub-Committee on carriage of cargoes and containers: This subcommittee usually meets once a year for 5-8 days and develops regulations related to carriage of cargoes.

CG – Correspondence Group [Formal discussion group established between IMO Sub-Committee sessions. The correspondence happens online]

FP- Fire Protection

SSE- Sub-Committee on ship systems and equipment: This subcommittee usually meets once a year for 5 days and develops regulations related to safety equipment

WG- Working Group [Formal discussion group established during the IMO Sub-Committee meeting. The correspondence usually happens in person at IMO]

2. **Container fires – regulatory development:**

Participants will be briefed about the regulatory developments on container fires aspects.

SOLAS Chapter II-2, Reg 10.7.3 - Firefighting for ships constructed on or after 1 January 2016 designed to carry containers on or above the weather deck

7.3.1 Ships shall carry, in addition to the equipment and arrangements required by paragraphs 1 and 2, at least one water mist lance.

7.3.1.1 The water mist lance shall consist of a tube with a piercing nozzle which is capable of penetrating a container wall and producing water mist inside a confined space (container, etc.) when connected to the fire main.

7.3.2 Ships designed to carry five or more tiers of containers on or above the weather deck shall carry, in addition to the requirements of paragraph 7.3.1, mobile water monitors as follows:

.**1** ships with breadth less than 30 m: at least two mobile water monitors; or

.**2** ships with breadth of 30 m or more: at least four mobile water monitors.

7.3.2.1 The mobile water monitors, all necessary hoses, fittings and required fixing hardware shall be kept ready for use in a location outside the cargo space area not likely to be cut-off in the event of a fire in the cargo spaces.

7.3.2.2 A sufficient number of fire hydrants shall be provided such that:

.1 all provided mobile water monitors can be operated simultaneously for creating effective water barriers forward and aft of each container bay;

.2 the two jets of water required by paragraph 2.1.5.1 can be supplied at the pressure required by paragraph 2.1.6;and

.3 each of the required mobile water monitors can be supplied by separate hydrants at the pressure necessary to reach the top tier of containers on deck.

7.3.2.3 The mobile water monitors may be supplied by the fire main, provided the capacity of fire pumps and fire main diameter are adequate to simultaneously operate the mobile water monitors and two jets of water from fire hoses at the required pressure values. If carrying dangerous goods, the capacity of fire pumps and fire main diameter shall also comply with regulation 19.3.1.5, as far as applicable to on-deck cargo areas.

7.3.2.4 The operational performance of each mobile water monitor shall be tested during initial survey on board the ship to the satisfaction of the Administration. The test shall verify that:

.1 the mobile water monitor can be securely fixed to the ship structure ensuring safe and effective operation; and

.2 the mobile water monitor jet reaches the top tier of containers with all required monitors and water jets from fire hoses operated simultaneously.

Participants will also be briefed about 2 Sub-committees at IMO that deal with the container fires topic.

1) CCC Subcommittee- deals with fire prevention aspect.
2) SSE Sub Committee- deals with aspects including fire detection, fire containment & firefighting

Due to the increase in the number of fire incidents onboard, there have been continuous entry of proposals in the IMO domain to improve the scope of fire handling.

The Maritime Safety Committee (MSC), at its 103rd session, having noted, in particular, the need for a holistic risk-based approach and prioritization of risk prevention and mitigation enhancement when developing amendments, agreed to include in the biennial agenda of the SSE Sub-Committee for 2022-2023 and the provisional agenda for SSE 8 an output on "Development of amendments to SOLAS chapter II-2 and the FSS Code concerning detection and control of fires in cargo holds and on the cargo deck of containerships", with a target completion year of 2025, in association with the CCC Sub-Committee as and when requested by the SSE Sub-Committee.

The Committee also agreed that:

1) the amendments to be developed should apply to new ships
2) the output was to amend regulations in SOLAS chapter II-2 and the FSS Code to enhance provisions for early fire detection and effective control of fires in containerized cargoes stowed on and under deck of containerships; and
3) the amendments to be developed should enter into force on 1 January 2028, provided that they were adopted before 1 July 2026.

Since SSE 8, few submissions have come to IMO on the container fires topic.

The proposals that are being considered are:

Submission	Title of Proposal	Proposer
SSE 8-10-1	Proposals for enhancing the capabilities of containerships for early fire detection in cargo deck	China
SSE 8-10-2	Comments on document SSE 8-10 [draft guidelines for the design, performance, testing and approval of water mist lance]	Denmark
SSE 9-10	Proposal for fixed water monitor for control of fire on the cargo deck of containerships	Qatar, Korea
SSE 9-10-1	Video fire detection system for on deck cargo area of containerships	Republic of Korea
SSE 10-10-1	Technical evaluation of the CARGOSAFE FSA study	IACS
SSE 10-10-2	Assessment of appropriate RCOs provided in the CARGOSAFE FSA study	France, BIMCO and IUMI
SSE 10-10-3	Proposal to forward a list of potential risk-prevention-related areas to the CCC Sub-Committee	Denmark, et al.,
SSE 10-INF.12	Detailed information on the performance tests and onboard tests of the Video Fire Detection System	Republic of Korea

Out of the contents of the proposal, the consideration is split as below:

SSE-11 to consider the following discussions:

- Fixed fire detection for containers carried on deck, including video fire detection system

The CARGOSAFE report outlines the usage of linear heat detection systems installed on deck up to the height of lashing bridge. Also, the video fire detection system as proposed by Korea has been considered.

- Protection of hatch covers: With regard to the protection of hatch covers, SSE noted the outcome of the consideration on active protection systems like spraying water horizontally below the hatch coaming and deluge systems integrated into the pontoon hatches, as well as passive protection systems, e.g. A-60 protection below the hatches.

The Correspondence Group (currently running) to consider the following discussions:

- Fixed Fire detection systems in cargo hold: The CARGOSAFE report outlines the usage of linear heat detection systems installed in the cargo hold. The working group initiated discussions on the effectiveness of point detectors as well.

- Portable infrared (IR) thermal imagers and thermometers: It was observed that the portable IR thermal imagers might be beneficial as supplementary tools for the early confirmation of fire and observing the development thereof, and the need for further discussion in the Correspondence group

- Water mist lances: The Sub-Committee noted that development of relevant guidelines on water mist lances was necessary. Therefore, the Sub-Committee instructed the FP Correspondence Group to consider the proposal by Denmark on the draft guidelines for the design, performance, testing and approval of water mist lances used for the protection of on-deck cargo areas of ships designed and constructed to carry containers on or above the weather deck.

- Mobile water monitors: With respect to the use of mobile water monitors, the Sub-Committee noted the need to explore if existing systems could be improved, e.g. revising MSC.1/Circ.1472 or adding new functionality, such as remote, directional control of these water monitors. Therefore, the Sub-Committee instructed the FP Correspondence Group to consider the matter in detail.

- Fixed water monitors [Boundary cooling only]: The CG to consider what kind of systems would be suitable for large deck cargo arrangements and analyze

implications of fixed water monitor systems. It was also discussed, the utility of carrying a Mobile Water monitor cannot be replaced by fixed monitors.

- Fixed CO2 fire-extinguishing systems: Regarding fixed CO2 fire-extinguishing systems, the Sub-Committee noted the need for further discussion on the matter and instructed the FP Correspondence Group to further consider the relevant requirements for fixed CO2 fire extinguishing systems applicable to containerships.

3. **Background- CARGOSAFE:**

Study investigating cost-efficient measures for reducing the risk of cargo fires on container vessels [CARGOSAFE]

CARGOSAFE is a safety study developed in accordance with the Formal Safety Assessment, MSC-MEPC.2/Circ.12/Rev. 2 Revised Guidelines for Formal Safety Assessment (FSA) for use in IMO rule-making process. The study is tendered and commissioned by European Maritime Safety Agency (EMSA). Its goal is to identify cost-effective measures for reducing the risk of cargo fires on containerships. The study encompasses both newbuilds and existing containerships.

The study took place in 5 stages:

1. HAZ-ID Workshops
2. Risk Analysis
3. Risk Control Options- Evaluation
4. Cost effectiveness of RCOs (Indices & Ratios)
5. Decision-making Recommendations

The final report of the CARGOSAFE project was published by EMSA. It can be accessed by clicking on the below link:

https://emsa.europa.eu/containership-safety/cargosafe.html

The study report was validated at IMO by the Experts Group on Formal Safety Assessment (FSA) which met from 23 to 25 October 2023. The Group, despite noting some concerns that would not affect the overall aim and conclusions, appreciated the study conducted by EMSA and agreed that:

1. the adequacy of scope of the FSA, definition of the problem; the validity of the input data; the adequacy of expertise of participants in the FSA; and the adequacy of accident scenarios, risk models and calculated risks, identified RCMs and RCOs were sufficient;
2. methodologies used and relevance of methods and tools for decision in the group(s) in the FSA; HAZID; calculation of risk; CBA; and sensitivity analysis were appropriate;
3. no deficiencies affecting the outcome had been identified;
4. the study was adequately conducted in accordance with the Revised FSA Guidelines;
5. the conclusions and the recommendations were credible, and SSE 10 was invited to consider the recommendations for further action.

After consideration by FSA expert group at IMO, in the following SSE Sub-Committee meeting the outcomes of the CARGOSAFE along with other proposals in hand with respect to the container fires were considered.

Following the Sub-committee meeting, a correspondence group was established. Discussions are underway on the container fire topic.

Based on the above information, participants are advised to provide their inputs, share their views on discussions as we go ahead with the discussions on individual Risk control options below.

4. Review of outcomes of CARGOSAFE:

General RCO discussions:

1) Fire Prevention
    - container screening tools (P1)
    - maintaining a database of rejected cargo (P2)
    - planning stowage (P3)
    - improvement of lashing on the deck (P4)
    - improvement of test methods on self-heating cargo (P5)
2) Fire detection
    - Optimization of the current system in place (D1)

      (current detection system - 300s to the overall detection time)
    - Heat detection looking at individual container temperature rise (D2)
    - Fixed IR cameras for heat/ flame detection (D3)

      (Portable IR cameras for crew members were mostly identified as a tool for confirming a fire)
    - CCTV-AI based smoke detection (D4)
    - Portable IR cameras distributed among the crew (D5)
3) Fire Fighting
    - CO_2 extinguishing system (F1)
    - Introduction of novel firefighting tools (F2)
    - Tools which increase the reach for the firefighters (F3)
    - Unmanned firefighting techniques (F4)
    - Water mist turbines (F5)
4) Fire Containment
    - Active suppression systems under the hatch covers (C1)
    - passive fire protection on the cargo holds (C2)
    - stack cooling techniques for firefighting on the deck (C3)
    - flooding the cargo hold (C4)

Table- Summary of cost-effectiveness of all RCOs for the 3 generic ships

RCO	RCO Description	Twin Island	Single Island	Feeder
P1	Container screening tool	Maybe	No	No
P4	Improved control of lashing	Yes	No	No
D1	Improving current smoke detection system	No	No	No
D1R	Improving current smoke detection system (retrofitting)	No	No	No
D2	Heat detection	Yes	Yes	No
D3	Fixed IR cameras	No	No	No
D4	CCTV - AI - smoke detection	No	No	No
D5	Portable IR cameras for crew to enhance manual detection	Yes	Yes	No
F1	Increasing effectiveness of current CO2 system	No	No	No
F2	Improved manual firefighting tools for individual container breaching and firefighting	Yes	Yes	No
F3	Manual firefighting tools that increase reach	Yes	Yes	No
F4	Methods for unmanned firefighting	Yes	Yes	Maybe
F4R	Methods for unmanned firefighting (retrofitting)	No	No	No
F5	Water mist canon	No	No	No
C1	Active protection underneath hatch covers to protect from fire spread towards the deck	Yes	No	No
C2	Passive protection to protect from fire spread towards the deck	Yes	Yes	No
C3	Fixed external container stack cooling system to stop spread between stacks	No	No	No

RCO (P1)	***Container screening tool [Scanning]***
Explanation	This RCO actually speaks about container scanning tool. As per FSA, this process is to be done at ports. As per the FSA, the risk of ignition can be reduced by scanning containers for • poor packaging , • poor dunnage, • mis& non declaration The AI and ML software shall be programmed to • screen random number (20%) of containers during terminal handling or inspection • compare the real time image of container with ideal condition • detect and flag the non-compliant conditions • rate the risk of this condition • get feed with photographs, analyse cargo & detect hazardous cargo
Technology readiness	• X-ray scanner at Mumbai port – detects contraband or prohibited cargoes • Eagle® P60 | Drive-Through Inspection System- Rapiscan Systems [Scans hazardous cargo]
Pros of the suggested technology	Enables easy identification of mis/un-declared cargoes inside the container.
Cons of the suggested technology	As per FSA, • investment cost • personnel cost • maintenance cost • cost for electricity • human supervision
Status at IMO	
Any company has implemented anything similar?	
How feasible it is for existing ships?	
Any other experiences?	

RCO (P2)	***Common database for rejected screening cargo***
Explanation	Common database for rejected screening cargo shares the minimum rejection criteria among the shipping companies. [Container that is flagged for rejection by one shipping company, is also flagged by other shipping companies as well]. As per the FSA, the risk shall not be pushed from one vessel to another vessel if the grounds minimum rejection criteria for all shipping companies are common and shared on a common database
Technology readiness	common industry library offered by National Cargo Bureau [Customer has a common (shared) and a private library].
Pros of the suggested technology	• encourage shared communication among shipping companies • reduce the risk of moving a hazardous container from one shipping company to another
Cons of the suggested technology	• certain information cannot be shared in public (competition laws) • fees associated with screening service and common library • costs for personnel and training for usage, • costs for maintain/update of database and procedures
Status at IMO	N/A
Any company has implemented anything similar?	
How feasible it is for existing ships?	
Cost effectiveness	

RCO (P3)	***Risk based stowage planning tool***
Explanation	Risk based stowage planning tool offers a plan of location of where a container can be stowed based on risk rating. As per the FSA, extreme incidents onboard and is combined with other safety measures. The ignition frequency is not reduced by this RCO.
Technology readiness	Risk-based stowage planning tool developed by Cargo Incident Notification System (CINS).
Pros of the suggested technology	Division of the cargo area on a containership in more detail can help the crew in decision making on how to fight a fire or to setup more specific systems depending on what dangerous cargo are expected in that area.
Cons of the suggested technology	• needs training and education for those who shall use it, thus, costs for implementing this RCO relates to personnel costs • non/mis- declaration makes such an RCO worth less than if all the cargo is properly declared
Status at IMO	N/A
Any company has implemented anything similar?	
How feasible it is for existing ships?	
Cost effectiveness	

RCO (P4)	***Improved control of lashing***
Explanation	As per the FSA, it is possible to avoid fire incidents arising from poorly lashed containers As per FSA, an improved control of lashing to avoid fire incidents arising from poorly lashed containers can be applied in various ways. Education and information are needed in addition to existing codes and regulations to steadily ensure that containers are properly stowed throughout the whole voyage. **The aspect highlighted in this RCO is to revise the amount of personnel and available time to perform monitoring of lashing during voyage, to have time to follow requirements, manuals and plans correctly and safely.** • focus on improvement of training of personnel doing the lashing monitoring, • increase the number of personnel performing the lashing monitoring, • revised rules focus on ergonomics, availability, and accessibility of lashing monitoring
Technology readiness	
Pros of the suggested technology	
Cons of the suggested technology	
Status at IMO	
Any company has implemented anything similar?	
How feasible it is for existing ships?	
Cost effectiveness	

RCO (P5)	***Improved test method for self-heating cargo***
Explanation	This RCO aims to improve the test method for identification of self-heating cargo for transport of dangerous goods. The currently existing test for self-heating goods for transport is the UN- N.4 Test. As this test is based on performance of a charcoal, the results are not necessarily applicable to “new” materials or different stowage geometries. Revision of the current test method into one or more test methods for different types of self-heating substances and thus reduce false negative classification and risks of ignition is required.
Technology readiness	N/A
Pros of the suggested technology	N/A
Cons of the suggested technology	N/A
Status at IMO	N/A
Any company has implemented anything similar?	N/A
How feasible it is for existing ships?	N/A
Cost effectiveness	N/A

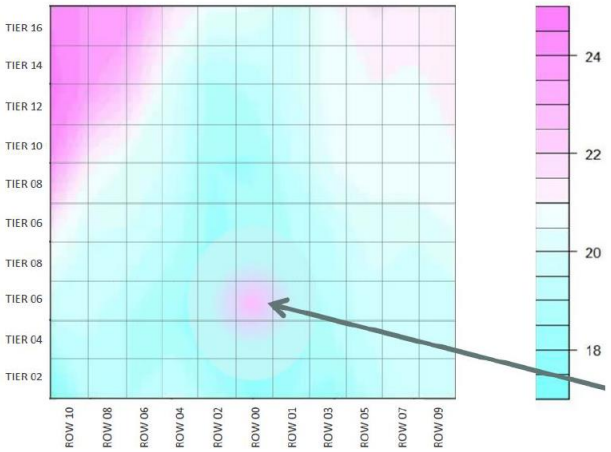
RCO (D1)	***Optimizing current system***
Explanation	Aim is to improve the current smoke detection system. Optimize the location of installation of detectors, so that, container to sampling point travel time is reduced. This can be achieved by: • Additional sampling points • Change of sampling point locations Reducing of smoke travel time to the detector unit [point detectors have no travel time for smoke to get to the detection point from the sampling point]
Technology readiness	Just Computational Fluid Dynamics (CFD) tested. Technology is not implemented yet.
Pros of the suggested technology	• Reducing of smoke travel time to the detector unit • Reduce the mixture of smoke from hold on fire and air from other hold/locations is reduced
Cons of the suggested technology	Additional cost for Installation/ retrofit.
Status at IMO	
Any company has implemented anything similar?	
How feasible it is for existing ships?	
Cost effectiveness	

<table>
<tr><th>RCO (D2)</th><th>Heat detection system looking at rise of temperature of individual containers</th></tr>
<tr><td>Explanation</td><td>

Self-heating events could occur inside container without the generation of smoke which can lead to a complete failure of the smoke detection system.
Identification of hotspots on container walls are very crucial
Electrical real time monitoring of container wall temperatures in place of mechanical smoke extraction and detection

</td></tr>
<tr><td>Technology readiness</td><td>

linear heat detection system – small & ATEX compliant
the temporal temperature variation of that specific container is monitored in combination with the spatial temperature distribution (i.e., heat map) to avoid false alarms.



Heat map with a hotspot (indicated by the arrowhead) in a single container source: [Radicos Technologies
</td></tr>
<tr><td>Pros of the suggested technology</td><td>

The devices should be installed within 20cm distance away from each container end wall
sensor readings are updated every second on the output visual (HEAT MAP)

</td></tr>
<tr><td>Cons of the suggested technology</td><td>

ON- Deck monitoring limitation due to stack height
Risks associated with mechanical impact during loading and unloading
In cargo hold, for a larger fire around 1000kW from the beginning it only takes less than a minute to increase wall temperatures by 30 deg. C. For smaller fires it takes over 2min before the end wall temperature is increased by just 10 deg C.

Summary of detection times for each different setting for the temperature monitoring system
<table>
<tr><th rowspan="2">HRR [kW]</th><th colspan="6">Temperature increment [s]</th></tr>
<tr><th colspan="2">+1°C</th><th colspan="2">+10°C</th><th colspan="2">+30°C</th></tr>
<tr><td></td><td>min</td><td>max</td><td>min</td><td>max</td><td>min</td><td>max</td></tr>
<tr><td>100</td><td>28</td><td>54</td><td>165</td><td>220</td><td>477</td><td>600</td></tr>
<tr><td>200</td><td>18</td><td>36</td><td>94</td><td>122</td><td>230</td><td>290</td></tr>
<tr><td>500</td><td>11</td><td>19</td><td>47</td><td>60</td><td>102</td><td>130</td></tr>
<tr><td>1000</td><td>8</td><td>10</td><td>28</td><td>36</td><td>58</td><td>75</td></tr>
</table>
(HRR- Heat Release Rate)
</td></tr>
</table>

Status at IMO	• For RORO ships, Linear heat detection system has been introduced in SOLAS regulation II-2/20.4.1.1.1 and the FSS Code chapter 9.2.3. • Discussions on Linear (or) point heat detectors are in the pipeline. • This system could complement any system on "heat detection of individual containers". Therefore, retain the existing requirements for sample extraction smoke detection systems. To be further considered at SSE-11.
Any company has implemented anything similar?	
How feasible it is for existing ships?	
Cost effectiveness	

<table>
<tr><th>RCO (D3)</th><th>Fixed IR cameras</th></tr>
<tr><td>Explanation</td><td>Fixed IR cameras on deck, aids in reducing the detection time

• Field-of-view [25° horizontal, 20° vertical, 25 mm high resolution lens]
• Operation temperature – [-20°C and 200°C] & up to 585 meters
• Needs Integration with the existing bridge computer system (or)
• Connected to a stand-alone console with a dimmable screen.</td></tr>
<tr><td>Technology readiness</td><td>Alpha Marine has developed a technology, tested on the Stena Scandinavia (Ro-Pax) by Class- BV & RISE.

<table>
<tr><td>Heat release rate</td><td>Distance from camera</td><td>Obstructed/ not?</td><td>Time of detection</td></tr>
<tr><td>80 KW</td><td>50m</td><td>NO</td><td></td></tr>
<tr><td>300 KW</td><td>50m</td><td>YES</td><td>3 min</td></tr>
<tr><td>80 KW</td><td>50m</td><td>Half</td><td><0.5 min</td></tr>
<tr><td>400 KW</td><td>50m</td><td>Rain</td><td>4 min</td></tr>
</table>
</td></tr>
<tr><td>Pros of the suggested technology</td><td>• Replaces visual detection by crew
• Reduction of detection time which is improving the probability of fighting the fire successfully</td></tr>
<tr><td>Cons of the suggested technology</td><td>• robustness to weather conditions becomes [Oil rigs uses this]
• lens is exposed to ice or dirt [Anti-ice system, cleaning alarm system]
• false alarm readings [Adjustable sensitivity]</td></tr>
<tr><td>Status at IMO</td><td></td></tr>
<tr><td>Any company has implemented anything similar?</td><td></td></tr>
<tr><td>How feasible it is for existing ships?</td><td></td></tr>
<tr><td>Cost effectiveness</td><td></td></tr>
</table>

RCO (D4)	***CCTV and AI smoke detection***
Explanation	Smoke detection using CCTV and trained AI which are being used in other venues, are not used in maritime.
Technology readiness	AI trained system incorporated in CCTV monitoring system by highlight parking is used in parking areas.
Pros of the suggested technology	The system is proven to be effective in tricky environments coupled with the need for as early as possible detection times to avoid large scale property damage.
Cons of the suggested technology	• moving and different backgrounds, larger area of coverage, changing weather conditions • The relative motion between vessel structure & atmosphere on deck- High probability of wrong information on origin of smoke detection • Dilution of smoke, in the gaps between two stacks challenges the detection • In case of higher relative wind speed, the smoke doesn't reach the top of the stack
Status at IMO	1. SSE 9-10-1(Korea) - Video fire detection system for on deck cargo area of containerships 2. SSE 10-INF.12 (Korea) - Detailed information on the performance tests and onboard tests of the Video Fire Detection SSE Sub-Committee noted that a linear heat detection system could be suitable for individual containers up to the level of lashing bridge. Having also noted the need for additional discussion, the Sub-Committee agreed to further consider fixed fire detection for containers carried on deck, including video fire detection systems proposed in documents SSE 9/10/1 and SSE 10/INF.12, at SSE 11.
Any company has implemented anything similar?	
How feasible it is for existing ships?	
Cost effectiveness	

RCO (D5)	***Portable IR cameras for crew***
Explanation	The infrared radiation that cannot be observed by the naked eye is detected by a thermal sensor attached to the camera lens. The electronic components convert the data sent by the detector into an image or colour map with a temperature distribution and show it on the display. Mainly used to confirm a fire. When used as the main detection system on deck, it requires a standard procedure for crew patrols.
Technology readiness	different types of portable infrared cameras on the market that can measure temperatures from -50 °C to 2000 °C
Pros of the suggested technology	Detects and measures the infrared radiation (also known as heat or thermal energy) of the object or the surrounding environment and displays it as an image or a colour map. Compared with fixed thermal cameras, it has the characteristics of mobility, flexibility, and portability, which can be used for daily patrol of the workplace to discover hidden hot spots in time and enhance the safety of the workplace.
Cons of the suggested technology	• Special conditions of the container ships (blew deck and on deck) • The need of more number of patrol personnel • Coverage- only a certain number of containers • Reflective surfaces (shiny metals) will give inaccurate readings.
Status at IMO	1) SSE 8-10-1(CHINA) - Proposals for portable infrared thermal imagers and portable infrared thermometers The SSE Subcommittee noted the benefits of this proposal as supplementary tools for the early confirmation of fire and observing the development thereof, and the need for further discussion. The CG is considering the topic. Keeping in mind the extensive support for carriage of these instruments in the WG, ICS is not un-supportive of the proposal. Also, training of seafarers on this topic should be dealt at ‘Advanced Fire Fighting’ course and not introduce any additional course.
Any company has implemented anything similar?	

How feasible it is for existing ships?	
Cost effectiveness	

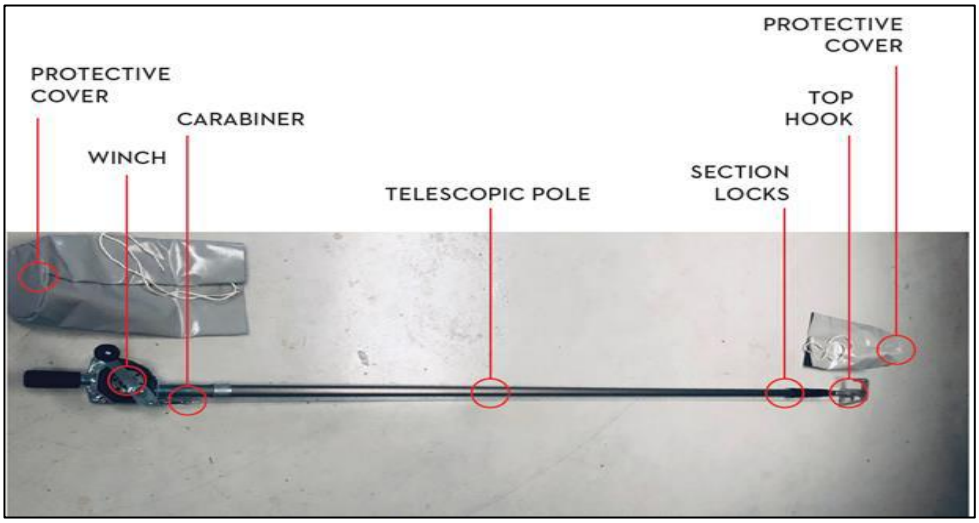
RCO (F1)	***Increasing effectiveness of current CO2 system***
Explanation	This RCO addresses the fixed fire protection systems on container ships for below-deck cargo holds. Specifically, the carbon dioxide total flooding system is supplied by either a low-pressure carbon dioxide (LPCO2) tank or a series of banks of high-pressure carbon dioxide (HPCO2) cylinders. As per FSA, Currently, limitations of the current CO2 system are : 1. compartment need to be well sealed 2. ineffective with oxidizer fuels (nitric acid, nitrogen tetroxide, etc.), low ignition temperature fuels (refined hydrocarbons), deep-set smouldering fires (coal, biofuels, etc.), and lithium-ion batteries 3. limited quantity of CO2 lack of test requirements
Technology readiness	• add more tanks (single bigger tank of LPCO2 (or) more cylinders of HPCO2) to increase the number of “shots” the system can provide • systems that can produce CO2 (or other inert gases such as N2) continuously.
Pros of the suggested technology	• extend the time in which the cargo hold is in a reduced oxygen state • may also allow greater penetration into the containers of fire origin.
Cons of the suggested technology	• more tanks will mean further maintenance requirements and other associated costs • only relevant for new builds, due to different CO2 injection procedure • additional fuel will be required for these systems and regular system performance checks may need to be carried out if CO2 generators are used • Performance dependent on the cargo hold being well sealed and quantity of stored CO2. • A total flooding CO2 system is not effective for smouldering fires, lithium-ion battery fires, and fuels with low-ignition temperatures or 185 classified as an oxidizer. • Without a discharge test during commissioning the performance cannot be ensured.
Status at IMO	SSE SC approved the following to be considered at correspondence group: 1) ways to improve reliability of the CO2 release system, noting the Revised guidelines for the maintenance and inspections of fixed carbon dioxide fire-extinguishing systems (MSC.1/Circ.1318/Rev.1); 2) reconsider design concentration and required discharging quantity and time (30% in accordance with the FSS Code, chapter. 5);

	3) ways to improve cargo holds ability to contain CO2 (hatch covers seals, ventilation inlets and outlets, etc.); and 4) oxidizers, assigned as class 5.1 according to the IMDG Code - how to address these cargoes
Any company has implemented anything similar?	
How feasible it is for existing ships?	
Cost effectiveness	

RCO (F2)	***Improved manual firefighting tools, for individual container breaching and firefighting (Lances)***
Explanation	SOLAS requirements for water mist lance and tube with a piercing nozzle is very vague. • More resources (firefighters & tools- hammers, ladders) required to use them. • Risk of misuse, risk to operator, unable to reach higher containers
Technology readiness	• hand-held high pressure water jet lance, • Lance- hung on ISO standard containers [The drilling unit (hole saw operated by water pressure) penetrates the container structures, The telescopic lift system enables the tool to reach stacked containers] 
Pros of the suggested technology	No need of continuous crew member attendance. As the water jet penetrates the obstacle, the water jet transforms into water vapor. This process consumes a significant amount of energy derived from the heat of the fire. The environment around the fire is cooled down and oxygen is consumed, resulting in the fire being extinguished.
Cons of the suggested technology	• Sparks/ rise in local temperature- when drilling a hole • Essential to determine cargo before fighting fire. • For cold cutting tools there must be sufficient water pressure and the hanging cutting tools can only be used on ISO standard containers • Occupational safety of personal when crew stands on the lifting equipment.
Status at IMO	SSE 8/-10-2 (Denmark)- draft guidelines for the design, performance, testing and approval of water mist lance system. The proposal can be supported in principle as a supplementary firefighting appliance onboard (Not to replace the lance systems that are currently in use). Limitations exist such as only being usable on the door side. For instance, if two 20’ containers are stored with doors facing the bay centre, the device cannot be used.

	The effectiveness of current lances also need to be considered. Resources are available that demonstrate the effective usage of the currently in-use lance system) ICS can support discussion on this topic only if substantial amendments to the proposed text are considered. For example, any supportive words in relation to the currently existing monopolistic technology cannot be supported.
Any company has implemented anything similar?	
How feasible it is for existing ships?	
Cost effectiveness	

[RCO F2 & F3 are inter-linked]

RCO (F3)	***Manual firefighting tools that increase reach***
Explanation	The penetration hammer and water mist lance, for example, can only access the first tier of containers above the lashing bridge. So, extendable firefighting appliances are required. The penetration hammer and water mist lance, for example, can only access the first tier of containers above the lashing bridge. For higher tiers container firefighting issues, the currently on-board tools are not efficient, so it is necessary to consider applying other tools to increase reach to improve the efficiency of manual firefighting.
Technology readiness	As explained above.
Pros of the suggested technology	The hanging tool attached to a telescopic pole system, can extinguish fires at height directly in burning containers. [Contains- telescopic lift system, hanging tool, Penetrating hole saw] 
Cons of the suggested technology	The working pressure at nozzle is about 4 bars. Lesser pressure may take longer to drill or may not penetrate the container.
Status at IMO	SSE 8/-10-2 (Denmark)- draft guidelines for the design, performance, testing and approval of water mist lance system. ICS cannot support the proposal as it is, but, We can include the same in the guidelines as an optional measure only. (As contained in para 3.6.5 of the proposal).
Any company has implemented anything similar?	

How feasible it is for existing ships?	
Cost effectiveness	

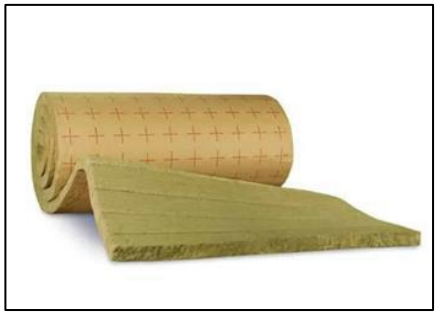
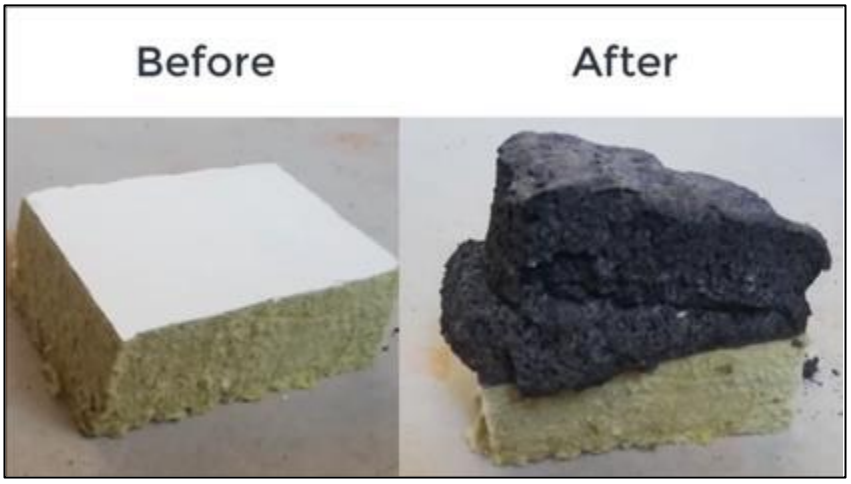
RCO (F4)	***Methods for unmanned firefighting***
Explanation	SOLAS II-2/10.7.3 lays out the requirements for the mobile water monitors. The monitor (As shown in the below image) along with a fixing device, is connected to the fire mains with a standard fire hose, this starts operating as soon as the hydrant valve is opened. The angle of the water jet is easily adjusted by a turning wheel, and the direction is set by turning the monitor. The monitor stays stable by itself and can operate if it is needed. The monitor can be temporarily fixed on the railings or ladders to start firefighting when the container is on fire.
Technology readiness	The monitors are already in use and various types are available in the market.  *(Mobile water monitor with fixing device)*  *(Remote-control water monitor)*
Pros of the suggested technology	• Can be temporarily fixed on the railings or ladders to start firefighting • The angle of the water jet is easily adjusted by a turning wheel • The monitor stays stable by itself and can operate if it is needed • Nozzle can also switch between spray or jet mode
Cons of the suggested technology	• high container stacks lead to difficulties in applying the extinguishing agent directly to the front of the container or indirectly between the containers • Can reduce the probability of container boundary cooling not effective • Minimum pressure and flow rates, mounting locations, steep angles, obstructions.
Status at IMO	**<u>Mobile Water Monitors:</u>** SSE Sub-Committee noted the need to explore if existing systems could be improved, e.g. revising MSC.1/Circ.1472 or adding new functionality, such as remote, directional control of these water monitors. **<u>Fixed water monitors (SSE 9-10- KOREA):</u>** As per SSE, The proposal to replace the current provisions of mobile water monitors, as in SSE 9/10, could not be supported.

	CG is considering the same. As the authors of the submission & delegates at SSE WG have considered the benefits of retaining the Mobile Water Monitors, the entire proposed text will need further consideration. Participants to note, this is a boundary cooling measure and not a firefighting measure.
Any company has implemented anything similar?	
How feasible it is for existing ships?	
Cost effectiveness	

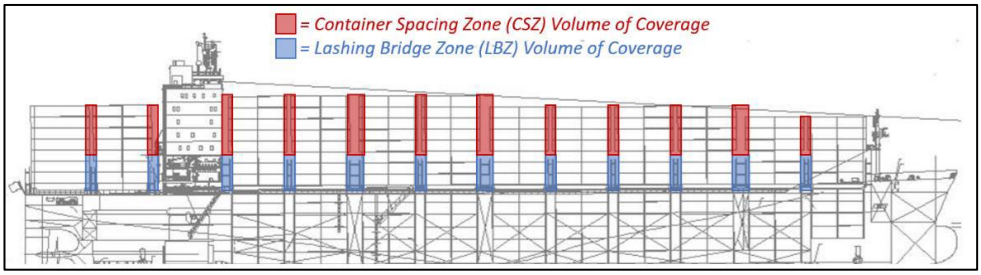
RCO (F5)	***Water mist turbine***
Explanation	This RCO addresses the lack of a fixed on-deck firefighting device to protect the surrounding container stacks A remotely controlled water mist turbine can offer additional fire protection to on-deck container stacks 
Technology readiness	Few manufacturers are available in the market. These manufacturers specifically cater to oil and gas industries.
Pros of the suggested technology	• Remotely controlled • Project a range of spray patterns ranging from a wide water mist cloud to a narrow water stream
Cons of the suggested technology	• To install this turbine aboard a container ship would require significant engineering adjustments by the manufacturer. • Mounting on top of the superstructure(s) to assist remote firefighting • Blind angles/shadow effects, Pressure requirements, Range of water spray/stream, Sea water corrosion, wind & weather effects
Status at IMO	
Any company has implemented anything similar?	

How feasible it is for existing ships?	
Cost effectiveness	

RCO (C1)	***Active protection underneath hatch covers to protect from fire spread towards the deck***
Explanation	The water spray system is required in case of carriage of dangerous goods and is then assumed to be designed in conformity to SOLAS II-2/19.3.1.3
Technology readiness	Due to the fact that this system is already required in some cases (e.g. when dangerous goods are carried), this technology is currently available in the market.
Pros of the suggested technology	More efficient to avoid above propagation when the fire is in the lower tiers of the hold.
Cons of the suggested technology	• As per SOLAS, the drainage system is to be sized to remove no less than 125% of the combined capacity of both the water spraying system pumps and the required number of fire hose nozzles • Minimum water pressure and flow rate, installation obstructions, only contain fire spread originating from the below deck hold.
Status at IMO	
Any company has implemented anything similar?	
How feasible it is for existing ships?	
Cost effectiveness	

RCO (C2)	***Passive protection to protect from fire spread towards the deck***
Explanation	3 types of protection measures are mentioned. Out of the 3, only hatch cover protection is analysed in detail. • Adding floodable ballast tanks between adjacent cargo holds to create insulation • Change the fire rating of construction (Bulkheads) to improvise passive fire protection • Hatch covers- Class A-60 division [bulk insulation (mineral wool, fiberglass, or equivalent roll of A-60 rated material) or an intumescent paint spray can be considered as passive protection]  *(Fibre glass)*  *(Mineral wool)*  *(Fig- Intumescent paint before and after heating)*
Technology readiness	Intumescent paint is commonly used
Pros of the suggested technology	• Fiberglass & mineral wool minimizes heat transfer and is an excellent non-flammable insulating material. • Intumescent paint is commonly used, cost-effective solution for passive fire protection
Cons of the suggested technology	• Skin and lung irritation if inhaled • Timely maintenance • Intumescent paint is highly sensitive to environmental exposure at the time of application. Therefore, timely maintenance and inspection or re-painting is needed.

Status at IMO	
Any company has implemented anything similar?	
How feasible it is for existing ships?	
Cost effectiveness	

RCO (C3)	***On-deck container stack cooling/containment system***
Explanation	Capabilities to contain a fire within the container stack of origin are discussed.  • Analysis of fixed water sprinkler system [Lashing bridge Zone (LBZ)] • Analysis of fixed water monitors [Container spacing zone (CSZ)]  
Technology readiness	low-pressure water mist systems, high-pressure water mist systems, and water curtain systems are available
Pros of the suggested technology	• Water monitors fixed to the lashing bridge will reduce the time for firefighting and containment operations • Remote control of the fixed water monitors would be possible
Cons of the suggested technology	• Obstructions in the lashing bridge zones, Pressure requirements, Reach of water spray from monitors, Wind & Weather deterioration. • Minimum pressure requirements
Status at IMO	
Any company has implemented anything similar?	

How feasible it is for existing ships?	
Cost effectiveness	

RCO (C4)	***Flooding cargo hold to a limited degree- up to a limited height***
Explanation	This RCO addresses the capability to contain a fire within a below deck cargo hold. In review of SOLAS II-2, the only mention of a cargo hold flooding system is in Regulation 19 regarding the carriage of dangerous goods. The filling of a cargo hold is possible from multiple routes: • temporary systems, • permanent systems, or • combination systems. A temporary cargo hold filling system refers to the use of manual hose-lines or equivalent systems to fill the respective cargo hold from the main deck through closeable openings. A permanent cargo hold filling system refers to the use of the ballast, fire main, and/or dedicated pumps in conjunction with a fixed piping network to fill the respective cargo hold. Additionally, gravity filling may be applicable for a permanent system on a case-by-case basis. A combination cargo hold filling system consists of a system that can use both a temporary and permanent system.
Technology readiness	https://ww2.eagle.org/content/dam/eagle/rules-and-guides/current/conventional_ocean_service/199_firefightingsystems_2022/foc-guide-may22.pdf ABS has got a class notation on flooding of cargo hold
Pros of the suggested technology	N/A
Cons of the suggested technology	• Shear and bending stresses on cargo hold/ballast tanks, need for separate water circuit and water removal pumps, secondary risks for refer containers. • **Dangerous Goods:** Activating a cargo hold flooding system would fill a respective cargo hold to a maximum fill level. All containers at or below this maximum fill level can be compromised with water impingement. The risk level can increase if the impinged container is a refer container or contains dangerous goods such as flammable liquids, class 4.3 goods, or lithium-ion batteries. • **Instability:** This containment tool can raise some issues regarding the stability of the ship due to a large free surface of water. Moreover, the bending and shear stress applied to the hold when filled must be considered during the building of the ship. ABS provides strength formulas for boundary structure and longitudinal strength. • **New Construction vs Retrofit:** Implementation of a cargo hold flooding system to an existing container ship requires installation of a significant piping network, central control station, and integration of many system components. This type of system would be easier to integrate into new construction container ships rather than retrofit.

Status at IMO	
Any company has implemented anything similar?	
How feasible it is for existing ships?	
Cost effectiveness	

5.Any other business

Participants are encouraged to raise any questions with respect to the discussions. Any topics that the participants feel necessary can be discussed here.

6. Conclusion

The meeting concludes.