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ANY OTHER BUSINESS

Update on the progress of the Top Tier Joint Industry Project (JIP) on container losses

Submitted by Australia, Germany, Kingdom of the Netherlands, IUMI and WSC

SUMMARY

Executive summary:	This document is to update the Sub-Committee on the progress of the Top Tier JIP on container losses.
Strategic direction, if applicable:	Not applicable
Output:	Not applicable
Action to be taken:	Paragraph 12
Related documents:	MSC 106/INF.16; MSC 104/17/4 and CCC 9/13

Background and summary of previously reported progress

1 The Maritime Research Institute Netherlands (MARIN) set up the Top Tier Joint Industry Project (JIP) on container losses in response to the reported incidents involving losses of containers overboard as outlined in document MSC 104/17/4 (Australia et al). Document CCC 9/13 (WSC) contains the most recently reported estimate by WSC regarding the number of containers lost at sea for the year 2022.

2 The JIP, which got underway in late July 2021 and will run until the end of 2024, is taking a root cause approach focused on actions that potentially could be taken to significantly reduce the number of containers lost overboard and to help further enhance the confidence in safe container carriage and operations. The JIP will identify and recommend improvements that are supported by the shipping industry and authorities responsible for maritime safety.

3 Furthermore, noting the recent outcome of MSC 107 where two related new outputs were agreed for inclusion on the post biennial agenda of CCC[1], the JIP aims to support the work of IMO on these matters.

1 "Revision of the *Revised guidelines for the preparation of the cargo securing manual* (MSC.1/Circ.1353/Rev.2) to include a harmonized performance standard for lashing software to permit lashing software as a supplement to the Cargo Securing Manual" and "Development of measures to prevent the loss of containers at sea".

4 At MSC 106, the partners of the JIP provided the first results and an update on the progress of the project (MSC.106/INF.16) and this was complemented with a presentation during MSC 106 raising awareness about the JIP. Since MSC 106, the IMO Secretariat has joined the JIP as observer.

5 The first results of the JIP reported during MSC 106 include:

.1 development of a first series of dedicated model tests focusing on parametric rolling incidents, sensitivity and handling;

.2 development and publication of a 'Notice to Mariners' calling for attention to parametric roll in following seas in particular and on how to prevent this in general;

.3 development and publication of three roll-awareness videos;

.4 development of a basic roll risk estimator tool for ships' crews which is freely available for use;

.5 findings from a crew questionnaire with 13 key points of attention, covering various aspects such as conditions of containers, difficulty in predicting vessel response to sea conditions, difficulty for ship crew to overlook overall the loading process, stowage and to validate inputs;

.6 findings from stowage surveys of planned and actual stowage locations, showing significant discrepancies for containers stowed on deck;

.7 development of a model test on container stack dynamics (scaled at 1:6) in an earthquake facility in Japan with a preliminary report on characteristics of container models and on comparison between calculation and measurement; and

.8 instrumentation of two vessels (one in Asia/Europe and one Asia/US loops) to assess cargo loads due to vessel motions and hull flexible deformation.

6 Further progress has been made since the last report to MSC 106. This paper provides an update on this progress below.

Phase I progress update

7 Project outputs are built upon phase I findings. These included a review of current practice, overview of incidents, feedback from crew on board and gap analysis. These findings show that the intake of cargo on container ships may be maximized up to the designed cargo carrying capacity and permissible loads of the ship's container stowage and securing arrangements. Furthermore, continuous inspection, maintenance and replacement, as appropriate, is required to maintain designed limits for lashings and containers. So is careful planning of the high tier container stows for each voyage in order not to exceed allowable limits. Safe container transport relies on control actions and feedback. Additionally, in-transit safety is determined by operational performance and uncertainties across successive steps, from stow planning, to loading at the terminal, and vessel handling in actual transit stage. Increasing safety implies maximizing performance of the following control loops:

.1 Strength of approved stowage arrangement: Securing/lashing arrangements and containers should meet approved strength requirements throughout the life of the vessel, lashing equipment and the container. This relies on inspection, maintenance and/or replacement standards.

.2 Stow planning: A preliminary stow plan is optimized against safe allowable limits of the containers and lashing gear. This relies on the vessel's stowage arrangement combined with availability and access to data on correct container dimensions, strength ratings, and content. Actual stowage relies on different computer programmes or different versions thereof running at the liner's offices, terminal planner's offices, and on board, as well as the data flows connecting them. On board lashing modules linked to the On board Stability Program perform the final evaluation of the proposed stow plan estimating design extreme motions and forces and evaluating against safe permissible loads within acceptable tolerances for lashings and containers. Key factors are timely data flow, data quality, standardization, realistic design motions, accurate calculated forces and reliable limit criteria. The complexity of the process, and variation in modern stow configurations exceed the scope of typically used CSM documents. In the same way that the CSM must be approved, where the stowage planning and lashing software is used to inform the approved loading plan, the software should be approved, with development of minimum standards and procedures for the same.

.3 Loading stage: The terminal loads the vessel according to the approved stow plan. Deviations from the stow plan in terms of mis-stowed containers, or containers with gross masses not in accordance with their declared VGM, are likely to result in forces on containers that exceed safe limits under in design conditions. Crew should check that deviations do not occur although this is challenging.

.4 In transit stage: The vessel must be operated inside the design limits used in stow planning stage. Motion response mechanisms that were not considered "In design" in stow planning stage have to be avoided. Awareness of actual levels for motions and loads in relation to the design limits used in stow planning stage is required along with awareness of the hazard of exceeding these limits in off design conditions in short and longer timescales.

Review of incidents, crew feedback

8 Root causes for incidents were evaluated using crew questionnaires and by reviewing typical incidents. Review of incidents was based on 44 identified cases as reported, described or pictured in the public domain. These were evaluated and discussed with experts inside the project. A gap analysis identified root causes tracing back to all stages of container transport including basic strength of equipment, planning, loading, and transit stages.

Phase II progress update

9 The scope of work in phase II was aimed at 6 different perspectives, each addressed in a dedicated working group (WG):

.1 **WG 1** (scope: Combined strength of container and lashing gear in relation to age and condition) Material testing of three containers conducted. This revealed a high variation in failure methods. Numerical simulations in progress to reproduce overall failure of container – lashing arrangement and sensitivity of strength to different failure modes.

.2 **WG 2** (scope: Port mis-stowage and VGM. Actual stow = approved stow planning representation) Uncertainty regarding stow planning and loading stage. Five surveys on the extent of container mis-stows showed large discrepancies between planned and safety approved stow, and actual loaded stow on deck. This highlighted the need for explicit feedback and control on stowage both for VGM and mis-stows. Further exploring methodology for examination of condition of lashing gear, containers, and corner castings. A workshop was recently organised to involve terminals and experts outside the project in discussion around problems and potential improvements.

.3 **WG 3** (scope: In design / off design extreme motions as relevant for stow planning and transit stages). A mix of measurements on board, model tests and numerical simulation is used to validate realistic in design extreme conditions used for stow planning and ensure that off design conditions such as parametric roll can be actively avoided. Outputs included notice to mariners warning for parametric roll, accompanied with clarification videos and an excel sheet. A second series of model tests is taking place to validate the boundaries of safe operation against parametric and synchronous roll.

.4 **WG 4** (scope: Performance of calculation models for stack and lashing forces in high tier cargo) Dynamic stack model tests were completed to validate the performance and margins for loading computer values that determine extreme loads in proposed stow plans under design extreme motion conditions. Comparisons and interpretations are in progress by cooperating class societies in the project.

.5 **WG 5** (scope: Decision support to operate "in" and avoid "off" design conditions at sea) Crew Governing Role and Control. Producing overview of required minimum information to handle vessel "in design" and propose how to present this information onboard. Preparation of feasibility experiment on parametric roll on a simulator. Reviewing requirements in SOLAS on availability of loading plan.

.6 **WG 6** (scope: Regulatory improvements to incorporate best practices considering outputs of WGs 1 to 5) Regulatory Reform. Ongoing review of challenges faced by ship's crew in dealing with ever more complex logistical challenges. Modern logistics is outstripping regulation and the capabilities of the ship's crew. Identifying appropriate entities (IMO Secretariat, ISO, IACS) and formulations for regulatory changes.

Phase III progress update

10 Ongoing work in phase II above will shape Phase III which is to include the conclusions and recommendations to be developed in the final stage of the project. An outline of these is found below:

.1 Combined strength of lashing equipment and containers must meet minimum standards under operational conditions, and their safe working loads must be available in stow planning stage. Inspection, maintenance and/or replacement standards are required to keep trace of and ensure the condition and combined performance of containers and ships' lashing gear.

.2 Developing minimum standards and procedures for stowage planning and lashing software, with a view to:

.1 potentially replacing the CSM;

.2 ensuring reliability of input data which describes the stow configuration, as well as safe working loads of the containers and lashings;

.3 addressing performance of algorithms estimating design extreme motions, and induced stack forces and lashing loads; and

.4 identifying transparent safety margins.

.3 After loading, the digital representation of the cargo stow matches the actual stow on deck and should be available to and approved by the crew for stow and vessel stability. A Verified Stowage Position (VSP) requirement is considered in addition to VGM. The reliability of VGM however may not be checked or enforced, and doubt may exist regarding its veracity. Consideration of terminal responsibilities and inspection and enforcement standards is needed to meet VGM and VSP requirements.

.4 In transit stage, ship crews must be aware of actual motion and load levels in relation to the design values. The bridge team must at all times have options, relevant information and empowerment to stay or return inside the safe operational parameters of the ship.

.5 Operating conditions must be avoided that can trigger "off design" responses, such as parametric roll and synchronous roll. It must be demonstrated that this can be effectively done, requiring successful prevention, recognition and handling of such events on strategic and tactical time scale.

.6 The regulatory framework must be updated to adopt above aspects in operating practice. It is expected that this may include:

.1 definition of target safety levels and transparent and actionable procedures;

.2 documentation of how off design conditions are actively avoided/handled;

.3 demonstration that required information, tools and alarms are in place; and

.4 updates to on board inspection and maintenance requirements for fixed securing arrangements conducted as part of the vessel statutory survey regime; and

.7 These requirements will need to be implemented partly in lashing rules as maintained by class and partly in overarching guidelines via ISO, IACS and/or SOLAS. At the same time, responsibility for operational compliance will need to be re-evaluated between all stakeholders involved, such as container owners and operators (container integrity), marine terminals (stowage), shippers (VGM), carriers (lashing integrity and vessel outfitting), crew on board (STCW), and flag and port State authorities (inspection/enforcement).

11 The identified issues will be listed and ranked according to their impact on overall safety and feasibility so that the expected timeline for improvements can be realistically introduced.

Action requested of the Sub-Committee

12 The Sub-Committee is invited to note the information provided.

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