Operational Research Support to Exercise SALISH SEA 2017

C. Eisler, Dr. P. Dobias, and Dr. T. Huber
Defence Research and Development Canada
Centre for Operational Research and Analysis
60 Moodie Drive, Ottawa, ON, K1A0K2
cheryl.eisler@drdc-rddc.gc.ca

Abstract

In 2015, Joint Task Force Pacific (JTFP), together with a number of federal and provincial agencies, conducted table top exercise (TTX) PACIFIC JEOPARDY to simulate a major maritime disaster (MAJMAR) off the coast of British Columbia, Canada. The Maritime Forces Pacific (MARPAC) Operational Research Team (ORT) was asked to assist in the assessment of the exercise, and to identify lessons learned and possible areas of improvement for MAJMAR contingency planning. Their observation report of the TTX documented numerous weaknesses of the exercise scenario and planning process. When a full scale live MAJMAR exercise was considered for 2017, the ORT was asked to assist with the development of a robust exercise planning and evaluation framework. This poster documents the development of the framework: from a clear definition of the exercise objectives, through the development of the progressive exercise steps (TTX, Emergency Operations Centre Exercise (EOCX), and Full Scale Exercise (FSX)), to the assessment framework reflecting the interagency objectives. The core planning team, of which the lead author on this paper was a member, all received Public Safety Canada's 2017 Emergency Management Exemplary Service Award – Search and Rescue Employees (Group).

Key words: Major maritime disaster, exercise, inter-agency response

Introduction

According to the Canadian Ferry Association (CFA) in 2015, over 55 million passengers and 19 million vehicles were carried by member owned and operated ferries in Canada [1]. BC Ferries is the largest passenger ferry line in North America and one of the largest in the world, operating 36 vessels on 25 routes, serving 47 terminals along the coast of British Columbia (BC), Canada and over 14.5 million passengers in fiscal year 2017/2018 [2]. Passenger cruise ships also operate in the same waters, with worldwide projections that indicated approximately 27.2 million passengers for 2018 [3]. Thus, one of the most potentially dangerous events to occur in the territorial waters off the coast of BC would be a major maritime disaster (MAJMAR) involving a large capacity vessel, such as a ferry or cruise ship.

The Commander of Maritime Forces Pacific (MARPAC)/Joint Task Force Pacific (JTFP)[1] is also the Search and Rescue Region (SRR) Commander for the Pacific SAR Region. Hence, in the event of a MAJMAR, it is his or her mission to prevent or minimize injury and loss of life through the expeditious and effective use of all available resources across the participating agencies in his or her area of responsibility [4]. Exercise series SALISH SEA provided an opportunity to exercise a MAJMAR scenario, identify areas to refine the

[1] The Commander MARPAC is double-hatted as the operational commander of the JTFP. In order to avoid confusion, this paper will use the JTFP to designate both MARPAC and JTFP.

procedures, and to build public confidence in a unified response to a MAJMAR event [5]. On behalf of the Commander MARPAC, his Chief of Staff Plans and Operations requested the MARPAC Operational Research Team (ORT) to lead the exercise evaluation for JTFP, as well as coordinate the evaluation between all participating agencies.

In order to exercise a multi-agency response to prepare for such an eventuality, key federal, provincial, municipal and other response partners met in 2015 to determine the initial exercise scope and objectives. The result was a progressive series of exercises, dubbed Exercise SALISH SEA 2017 (EX SASE 17). On 25-27 October 2017 this series culminated in the largest multi-agency MAJMAR exercise in Canadian Coast Guard (CCG) history [6] to date, with nearly 1,300 Canadian and United States emergency management and Search and Rescue professionals from over 20 participating agencies, plus local volunteers, and nearly two dozen ships and aircraft. This live full scale exercise (FSX) concluded almost two years of planning effort that included two incremental events: Table Top Exercise (TTX) Salish Sea in May 2017 and Emergency Operational Centre Exercise (EOCX) in September 2017.

Common themes that arose over the course of the exercise informed recommendations to shape the redefinition of both regional and federal contingency response plans. This paper provides an overview of the operational research support methodology, as well as key highlights and observations from the exercise. It is organized as follows: first, the exercise scenario, methodology, and objectives are provided; then the overall evaluation methodology is presented; and finally the observations are discussed. The paper relies on interim reports from individual components of EX SASE 17, as well as on the final inter-agency After Action Report (AAR) [6].

Exercise overview

Because of the inter-agency nature of the exercise, with many of the participating agencies having limited experience with large-scale exercises, a relatively straightforward MAJMAR scenario was developed for this exercise [6] (verbatim, Figure 1):

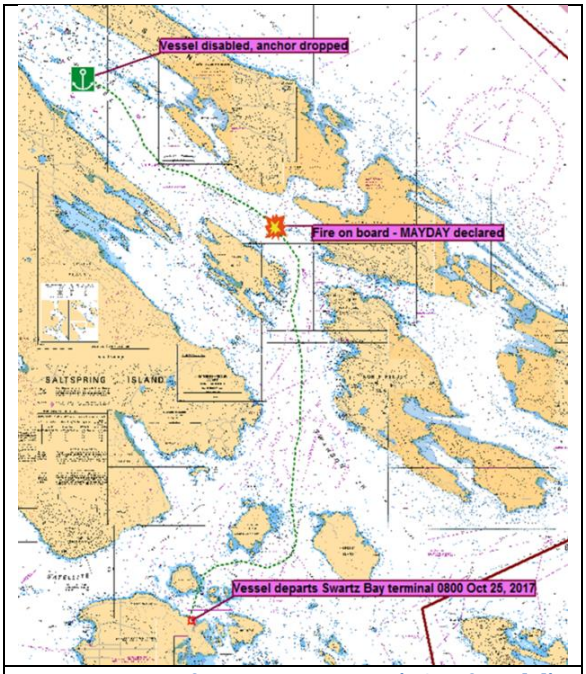

Figure 1: Day 1 of Exercise SASE 2017 (taken from [6]).

On 25 October 2017 (Day 1), the BC Ferry Motor Vessel (M/V) COASTAL RENAISSANCE, in communication with Marine Communications and Traffic Services (MCTS) Victoria, initiated the exercise at 0850hrs by declaring a Mayday as they proceeded along their route from Swartz Bay to Tsawwassen Terminal, just prior to entering Active Pass. The ferry reported that it was carrying 1,385 passengers and 61 crewmembers; an evacuation order was ordered due to a fire on the car deck that the crew was not able to extinguish. The ferry then proceeded to position 48º54.4'N 123º29.3'W where they stood station as one evacuation slide and one life raft was deployed. A BC Ferries tender was also deployed. 97 live actors (representing ferry passengers) employed from Joint Task Force Pacific (JTFP) were safely evacuated from the ferry.

[The Joint Rescue Coordination Centre (JRCC)], through MCTS Victoria, then tasked the following Canadian

Coast Guard assets: the Canadian Coast Guard Ship (CCGS) CAPE NADEN, CCG Hovercraft SIYAY, CCGS BARTLETT and their Fast Rescue Craft (FRC), and the US Coast Guard (USCG) Cutter ADELIE. JRCC also tasked six (6) Royal Canadian Marine Search and Rescue (RCM-SAR) units, a Royal Mounted Canadian Police (RCMP) vessel, a Parks Canada vessel and the Her Majesty's Canadian Ship (HMCS) REGINA (acting as the Ready Duty Ship of the day). Air assets tasked by JRCC included: a Cormorant CH-149 helicopter, a Buffalo CC-115 aircraft, a Sea King CH-124 helicopter, an Aurora CP-140 aircraft, a Transport Canada Dash 8, and a USCG Dolphin helicopter.

In addition to the live actors from the ferry, an additional 200 volunteers from Salt Spring Island simulated evacuated passengers on shore. The evacuated passengers were triaged and treated by [British Columbia Emergency Health Services (BC EHS)] staff, assisted by local first responders, at the Casualty Reception Point. Emergency Social Services were engaged to simulate the care and transport of non-injured passengers. Ground Search and Rescue teams were employed on shore. Multiple federal, provincial, local and non-government EOCs coordinated information exchange in order to account for all ferry passengers successfully.

While Day 1 of the exercise was focused on SAR and casualty triage and tracking, Day 2 of the exercise transitioned to consequence management and environmental response. Contingency planning is the key to planning a response to large-scale events such as a MAJMAR with serious potential consequences. It is likely that as a result of MAJMAR, large numbers of people would be in distress, exposed to the risk of loss of life and limb; survivors would require care over an extended period potentially in a remote location. Another factor adding to the complexity of such an incident is the rarity of it. Consequently, additional planning and training are required to prepare for this type of extreme event. This was reflected by the fact that two out of four primary objectives focused on evaluation and improvement of plans and processes, and on the mass casualty operation processes.

The Core Objectives of the exercise, agreed upon by all participating agencies, were to [6]:

A. Validate compliance with following existing major marine disaster plans, and assess their interoperability:
    1. JRCC Major Marine Disaster Plan [7],
    2. JTFP CONPLAN MAJMAR (Draft) [4],
    3. Emergency Management BC (EMBC) All-Hazard Plan [8],
    4. Marine Safety Management System - Environmental Prevention and Response National Preparedness Plan, and
    5. CCG Environmental Response Marine Spills Contingency Plan [9].
B. Identify and validate casualty management processes;
C. Demonstrate ability to effectively share Situational Awareness (SA) and maintain a common operating picture (COP); and finally
D. Confirm the incorporation of lessons learned from previous major maritime disaster exercises or similar events.

These objectives provided a common framework for evaluating performance at the agency level and from an inter-agency perspective. Each of the participating agencies identified its own additional objectives. Important to note was that the exercise was conducted in a no-fault learning environment. Where the plans, capabilities, and processes were evaluated, it was not intended as an assessment of the individual participants.

Under the larger exercise framework, three additional training objectives were developed for JTFP/JRCC in particular [10]:

1. Activation of Battle Watch Operation Centre (BWOC), and development and maintenance of the COP link between Federal, Provincial, and local authorities' EOCs;
2. Validation of the Change of Operational control (CHOP) between Canadian Armed Forces (CAF) operations centres; and
3. Validation of JRCC and JTFP contingency plans (CONPLANs) MAJMAR.

Because of its limited mandate, the MARPAC ORT only supported the assessment inter-agency objectives and the internal training JTFP/JRCC objectives [11]. The objectives of other participating agencies were outside of its scope.

Operational Research Support

In 2015, the concept for a regional MAJMAR exercise was developed between the CCG, JTFP, Public Safety Canada (PS), Emergency Management BC (EMBC), BC EHS, and BC Ferries. As none of these organizations had practiced together in a regional maritime exercise before, a progressive series of exercises was proposed to train staff in the skills required to lead up to a full-scale event. As familiarization occurred with the processes involved and a common understanding developed, the scope of the individual exercises increased, with greater numbers of participants and required tasks (see Figure 2). The "crawl, walk, run" strategy would also permit a phased approach to completion and comparative re-evaluation of exercise objectives. The first step in this approach was a MAJMAR seminar called Exercise PACIFIC JEOPARDY 2015, to which the MARPAC ORT was invited to participate as observers [12]. As a direct result of the recommendations made from this exercise, when EX SALISH SEA 2017 was contemplated, the MARPAC ORT was asked to support design, planning and evaluation of the exercise from the very beginning.

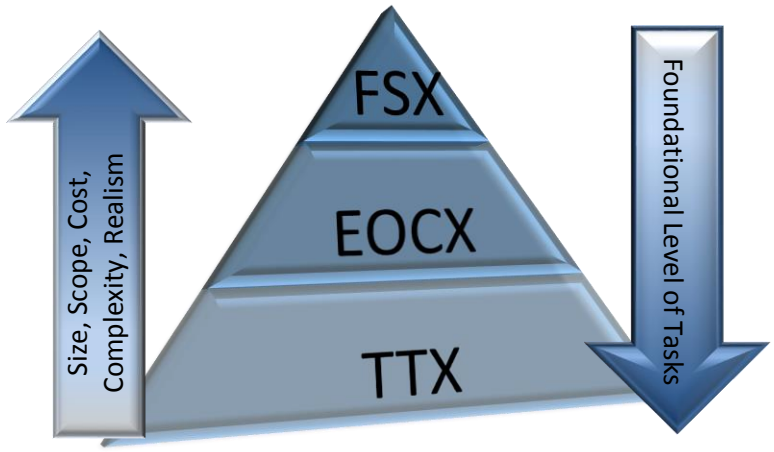

Figure 2: Progressive exercise series.

Starting with the initial TTX, the ORT developed a quantitative assessment framework that mapped the participants' activities to the CONPLAN-mandated tasks (Figure 3). It also provided a framework employing pre-defined game cards for evaluating data flow, timeliness and COP coherence across the participating agencies (Figure 4).

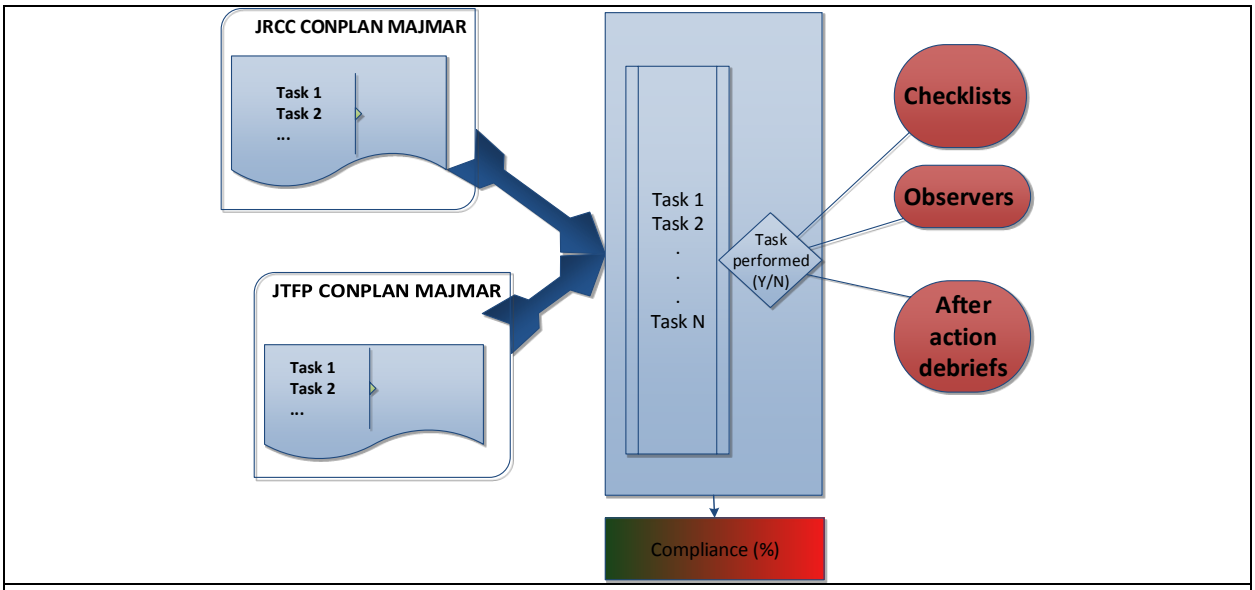

Figure 3: Assessment of CONPLANs during EX SALISH SEA 2017.

This assessment framework was incorporated into the actual scenario injects. This integration enabled robust assessment that was further strengthened by direct observations, as well as debriefing the participants. The assessment was further strengthened during the EOCX, when the actual messages between different participants were tracked and compared with injects. Lessons learned from these two events were then employed during the live exercise, which was supported by a dedicated team of assessors and evaluators. This contributed to the overall robustness of the final assessment. Rather than relying on subjective assessments of the planners and participants, a series of quantitative assessments was conducted.

For the live FSX, the MARPAC ORT prepared a comprehensive assessment framework, and it also advised and supported development of the assessment methodologies by other agencies to ensure the coherence of the assessment. Finally, the MARPAC ORT led the inter-agency ARR, signed off by the senior leadership of the participating agencies.

Exercise Execution and Assessment Framework

As a result of the experiences and recommendations from the TTX [13] and EOCX [14], the execution and assessment plans for the live exercise were refined. The participating agencies developed a reasonably good understanding of each other's operating procedures and expectations, and the assessment frameworks were largely coherent across the participating organizations. There were deliberate exceptions, caused by the fact that participating agencies' individual training objectives could differ from one agency to the next (such as on-shore consequence management or environmental response). All this provided a robust framework that enabled effective assessment against the exercise objectives.

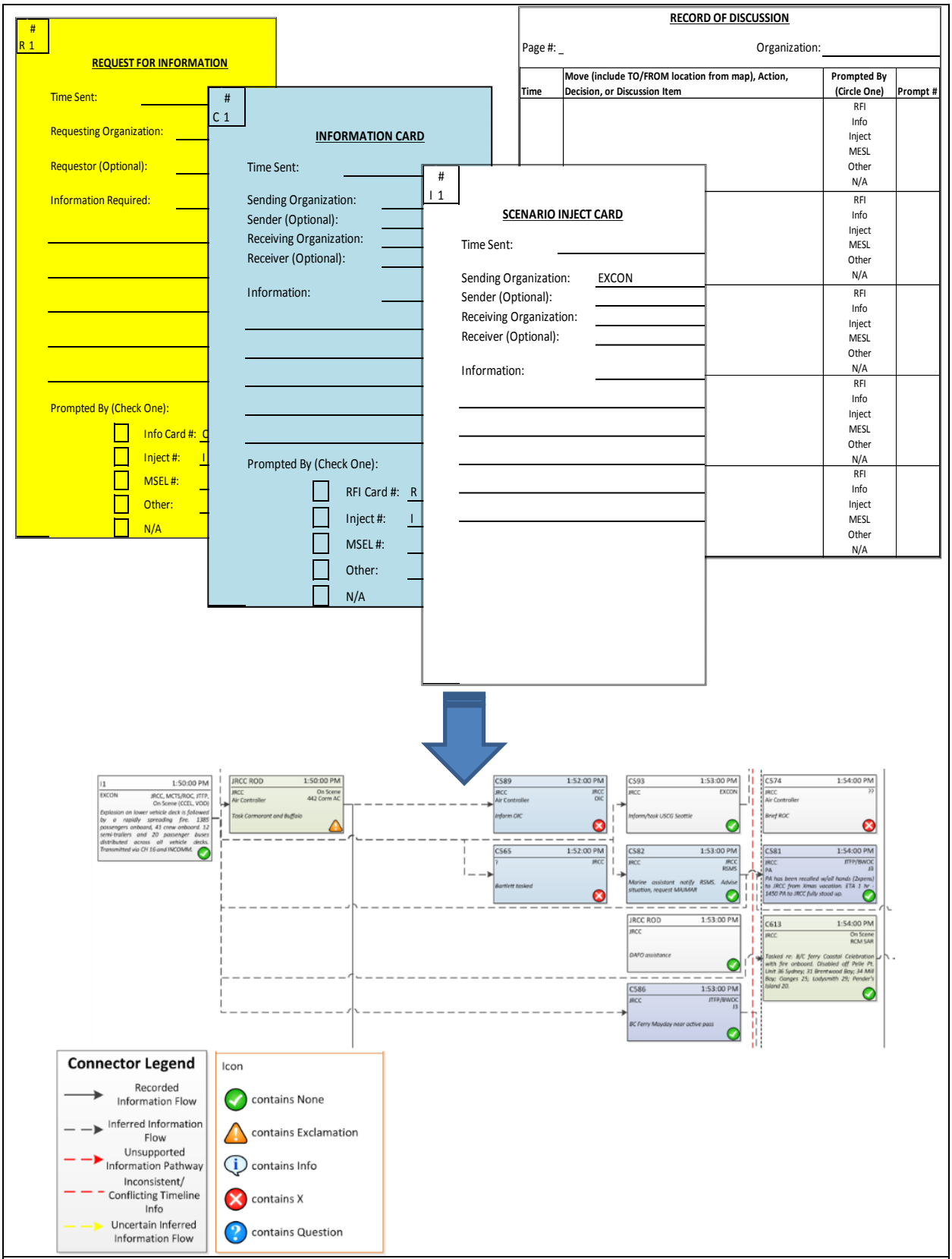

Figure 4: Evaluation of COP across participating agencies (example of playing cards (top) and resulting information flow (bottom)) [13].

As outlined above, the first day of the live exercise included the evacuation of a Coastal Class ferry due to a simulated fire on board, the on-water rescue of 97 persons from a life raft, and transportation of the evacuated personnel to shore for triage and treatment [6]. In addition, the exercise included the simulated[2] evacuation of the remaining passengers and crew for transport to casualty reception centres on Salt Spring Island. The field activities during the exercise were coordinated through multiple EOCs operated by federal, provincial, and local agencies. The second day of the exercise focused on the environmental response and containment strategies in order to protect specific environmentally sensitive areas, as well as salvage of the vessel. These follow-on activities did not involve MARPAC personnel, and were coordinated by the Canadian Coast Guard.

The FSX activities took place at multiple locations (on water, at various federal and provincial Emergency Operations Centres, at designated land locations, etc.). Controller/evaluator teams were assigned to each location, depending on the individual agencies' focus. In some cases, liaison officers were assigned to these teams to enable inter-agency coordination and responses in case of unforeseen events.

In order to accommodate wide participation of civilian agencies, and to ensure safety of the participants, the following artificialities/limitations applied during the live exercise (and to an extent, during the TTX and EOCX as well) [6]:

- Exercise communication and coordination was limited to participating exercise organizations, venues, and the simulation cell. While, in reality, there would likely be a wide range of external stakeholders and actors (government officials, foreign embassies, media, etc.), these were ignored for the purpose of the exercise.
- While acknowledging that in a real-life emergency all available communication means would be employed, only the communication methods listed in the Communications Plan were available for players to use during the exercise.
- Only 97 actors in a single raft were used in the on-water field activities during the exercise. Another 200 volunteer role players represented evacuees after landing on Salt Spring Island. All other passengers and crew were simulated.
- The Casualty Reception Point was determined prior to the start of the exercise, while in reality it would be decided after the rescue operation commenced.
- Exercise activity on Day 1 concluded by a set time, with the understanding that the realistic rescue and recovery of all 1,400+ passengers and crew would take a considerable length of time, subject to weather conditions and the location of a MAJMAR incident.
- Public Affairs, crisis communications, and social media outreach on Day 1 of the exercise were focused on real-world media response and promotion of the exercise. There were no common media injects on Day 1 of the exercise, and there were no simulated interagency press conferences or media releases. It was understood that during a real-world incident, crisis communications and social media engagement would be extensive, and additional public affairs personnel would be required.

Because of the high degree of required inter-agency coordination, a common Exercise Evaluation Guide [15] was prepared by the MARPAC ORT, with subordinate organization or agency-specific guides reflecting their unique training objectives and critical tasks. The inter-agency guide captured the high-level evaluation plan relative to the main exercise objectives. In order to facilitate better assessment, the JTFP/JRCC objectives were incorporated with the main plan. Each evaluator was provided with the

[2] For practical and financial reasons, it was not possible to have sufficient number of live actors, as the scenario stated there were over 1,400 personnel on board, including passengers and crew.

relevant guide(s), associated Exercise Evaluation Forms, the Controller/Evaluator Handbook [16], and an exercise communications log for the venue that they were assigned to evaluate. [3]

A framework similar (but much more comprehensive) to that used for the TTX and EOCX events was developed. The task tracking was conducted using players' log books, observers' communication logs and tracking emails (all emails among participants were being copied to the controllers' inbox set up specifically for this purpose). In addition, Automatic Identification System (AIS) data logs were used to track all on-water assets; the actual locations were then correlated with the reported locations from the logs.

For the JTFP-specific assessment, the evaluation team relied on a robust framework provided by the CAF Lessons Learned process [17] and applicable naval policy [18]. The JTFP-specific feedback was obtained employing participant survey, records of observation, hot-wash notes, and various electronic logs. These were then aligned with the exercise objectives, the Lessons Learned doctrine, organization, training, materiel, leadership and education, personnel, facilities, interoperability frameworks, and navy's critical topics list [10].

Observations

The EX SASE 17 Core Planning Team, as the coordinating body for the after-action review, examined a wide variety of qualitative and quantitative evaluations of exercise objectives from participating agencies. This input was collected through each agency's evaluation team during the exercise and reported on during the After-Action Review Conference.

The exercise demonstrated that the need for a MAJMAR plan was valid, or for those agencies that have an "all-hazards" style plan, that a Major Marine Disaster-specific annex, addendum, or worksheet is appropriate to cover unique requirements of such a scenario. It also showed that the basic concepts outlined in the current plans provide a solid foundation for responding to a MAJMAR. On the other hand, the exercise also highlighted deficiencies and redundancies in the current plans. One of the key identified issues was the need to determine the relationship between the CAF and CCG in a Supported/Supporting Commander scenario, because different policies assign responsibilities differently. On a task-by-task basis, Figure 5 shows the compliance of the JRCC/JTFP with the existing plans between TTX, EOCX, and live FSX to evaluate Core Objective A. It shows that as the participants became more aware of existing plans, the compliance increased. This reinforces the overall observation that it is vital that this type of inter-agency exercises is conducted regularly. [11]

Core Objective B had two distinct aims, assessing the accuracy of passenger and casualty tracking, and assessing the effectiveness of the casualty triage system. Data were tracked as best able, as simulated passenger/casualty tracking summary counts were not formally reported to a single authority in order to ensure that all casualties were processed, tracked, and reported appropriately. BC EHS had the lead on the latter aim, and it was beyond of the scope of the MARPAC ORT. [11]

[3] Developed based on the Federal Emergency Management Agency (FEMA) templates [19].

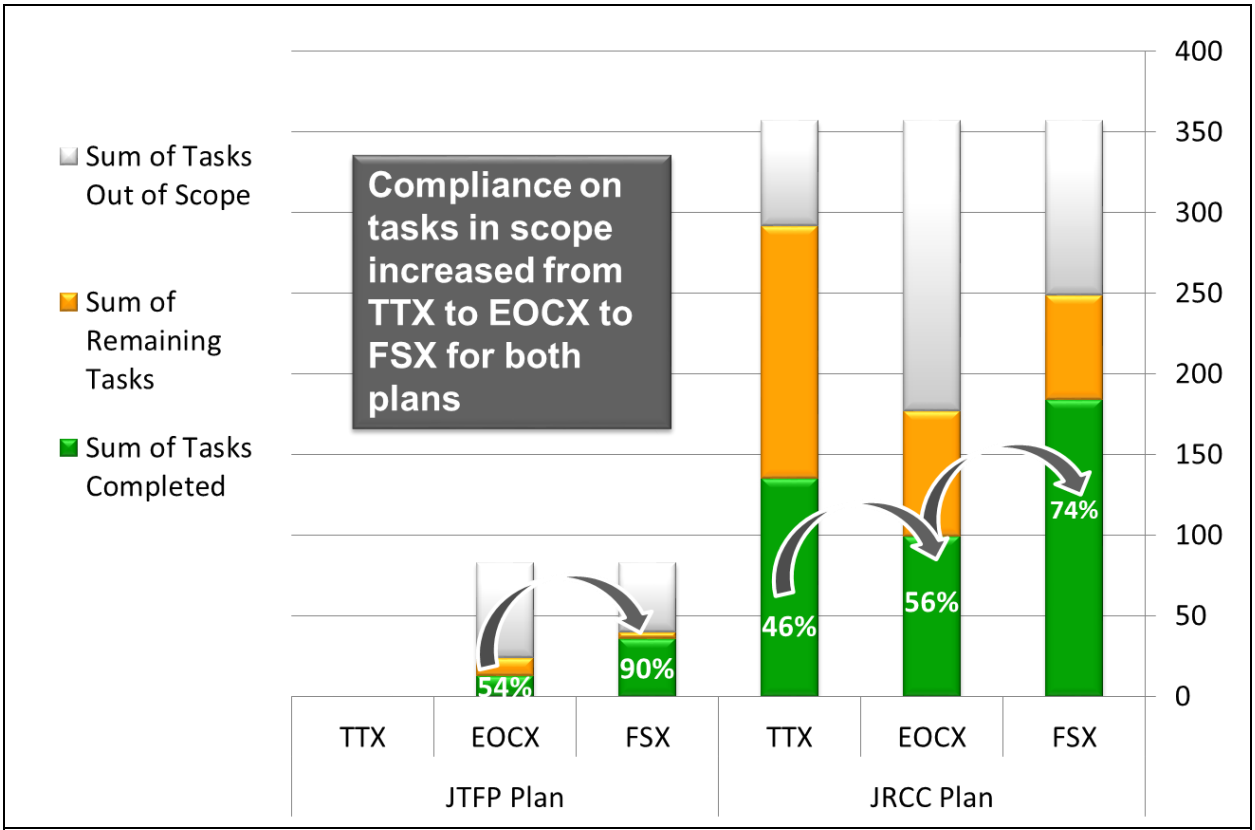

Figure 5: JTFP/JRCC compliance with MAJMAR plans (taken from [11]).

Core Objective C revealed a critical gap – a lack of a true COP that would be shared by at least the key agencies (JTFP, CCG, EMBC, BC EHS, PS, and BC Ferries). While there was a willingness among the exercise participants to review possible options in the run up to the exercise, real-world events took priority over the summer prior to the exercise series, and the correct subject matter experts within each agency were not engaged in the planning process. It was recommended that all response agencies should work together to identify the requirements, and to implement a COP at the inter-agency level that would connect the individual agencies' COPs. [6][10][11]

The assessment of the shared SA was captured through the passage of major platforms' position records. All source electronic logs that were made available (including the JRCC log, the Marine Communications Traffic Services Centre log, and email communications) were compared against the last known AIS report available from an unclassified data query from the JTFP Regional Joint Operations Centre (considered relative "ground truth"[4]). Both the accuracy of the position and the time latency of the platform position reports were evaluated. The position records were up to 2.6 nm off the last known AIS position; this distance could potentially have a large impact on actual operations in complex geographic areas or under inclement weather. Due to the ship's movement, increased latency could also have negative impact on the localization attempts. These inconsistencies in the SA further reinforce the need for a shared COP across main agencies. [10][11]

[4] It is understood that AIS data is not error-free and additional analysis was completed to confirm the validity of the points against which the reports were corroborated.

Using a stoplight assessment on the list of relevant lessons learned, it was determined that approximately half of the lessons learned from previous events have been incorporated into the large-scale disaster planning process (Core Objective D).

In addition to the objectives of the exercise, a number of recommendations were made regarding the design of the exercise itself. Previously, it was suggested that a regular tiered series of major maritime disaster exercises be performed with objective, qualitative, and quantitative evaluations to determine if action items from improvement plans are being followed up appropriately [11]. The following were among the key recommendations made to the JTFP organization:

- Deliver less detailed information ahead of FSX to participants in order to rely on information flow through appropriate channels.
- Maintain real-time/scenario timeline alignment by simulating any away time (e.g. overnight) in a multi-day exercise.
- Develop alternative scenario execution paths in case of events outside of exercise control.
- Utilize additional Table Top Wargames to examine highly challenging scenarios that may be too difficult, expensive, or unsafe to perform in a live exercise, but are necessary to understand the full range of potential requirements. Employ such TTX to validate developed Courses of Action (COAs) and capability requirements for these COAs.
- Utilize the same communications channels for any EOCX as the following FSX in order to test the communications plan.

Future Recommendations

The EX SASE 17 series of exercises served to improve collective effectiveness in emergency management and environmental response, building stronger partnerships between participating agencies. The principal agencies were CCG, JTFP, PS, EMBC, BC EHS, and BC Ferries. The findings the individual components (TTX [13], EOCX [14], and the live exercise [10]) reinforced each other. The key recommendations could be summarized as:

- Consider revising all agencies' CONPLANs to work in an integrated fashion to handle the progression of a MAJMAR incident. This process needs to be collaborative and reflect appropriate legislative authorities.
- Clearly define the Command and Control structure, including the tasking authority, reporting chains, and transition of authority points.
- Develop a shared COP accessible to all key agencies, and ensure that it is interoperable with the individual agencies' COPs.

This would simplify coordination across agencies, limit duplication of effort, and avoid potentially conflicting tasks assigned multiple CONPLANs. The recommendation to revise plans is currently being implemented, as is the development of a shared COP.

The exercise series also proved the value of embedding the operational research team in the exercise planning from the initiation. The presence of the MARPAC ORT ensured that the defined objectives were specific and measurable, and that the assessment framework was aligned with the objectives. It also ensured that the right information was collected, and that the outputs and assessments were robust and as objective as possible. Hence it was recommended that future interagency exercises include integration of operational research support from the beginning, and that the support mandate is expanded to include planning and assessment across all agencies. This has resulted in a wider use of such operational research support in other scenario areas, such as consequence management for JTFP's planned participation in a

whole of government response to a regional earthquake scenario in a series of similarly designed progressive exercises.

References

[1] Canadian Ferry Association, Industry at a Glance [Online]. Available: http://www.canadianferry.ca/ferries-in-canada/industry-at-a-glance/ (Accessed 24 Jun 2019), 2018.
[2] BC Ferries, Traffic Statistics [Online]. Available: http://www.bcferries.com/about/traffic.html (Accessed 24 Jun 2019), 2019.
[3] STATISTICA, Number of passengers of the cruise industry worldwide from 2009 to 2018 (in millions) [Online]. The Statistics Portal, Available: https://www.statista.com/statistics/385445/number-of-passengers-of-the-cruise-industry-worldwide/ [Accessed 24 Jun 2019], 2018.
[4] Joint Task Force Pacific, JTFP CONPLAN MAJMAR, Draft, 6435-3120-1 (J7/RDIMS 678588), Sep. 2017.
[5] EX SALISH SEA 2017, Exercise Directive – SALISH SEA 2017, 6435-4500-1 (J7/RDIMS 704677), Sep. 2017.
[6] Exercise SALISH SEA 2017: Inter-Agency After Action Report, Canadian Coast Guard, 2018.
[7] Joint Rescue Coordination Centre, JRCC Victoria Major Maritime Disaster Plan (CONPLAN MAJMAR – CCG and CF Response to a Major Marine Disaster), 2015.
[8] Emergency Management British Columbia, The All-Hazard Plan. Available at: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/provincial-emergency-planning/embc-all-hazard-plan.pdf (Accessed 24 June 2019), 2012.
[9] Canadian Coast Guard, CCG Marine Spills Contingency Plan - National Chapter (online), Government of Canada. http://www.ccg-gcc.gc.ca/folios/01230/docs/MSCP2018-eng.pdf (Accessed 24 June 2019), 2013.
[10] Eisler, C., P. Dobias, T. Huber, Interim Evaluation of Exercise SALISH SEA 2017: Specific Findings, DRDC-RDDC-2018-L022, Jan 2018.
[11] Eisler, C., P. Dobias, T. Huber, Preliminary Evaluation of Exercise SALISH SEA 2017: Full Scale Exercise, DRDC-RDDC-2017-L394, Dec 2017.
[12] Eisler, C., P. Dobias, Observations and Recommendations from the Table Top Exercise PACIFIC JEOPARDY 2015, DRDC-RDDC-2015-L185, 2015.
[13] Eisler, C., P. Dobias, Exercise SALISH SEA 2017: Table Top Exercise, DRDC-RDDC-2017-L193, Jun 2017.
[14] Dobias, P., C. Eisler, Exercise SALISH SEA 2017: Evaluation of Emergency Operations Centre/Command Post Exercise, DRDC-RDDC-2017-L311, Sep 2017.
[15] Eisler, C., et al., EXERCISE SALISH SEA 2017: Exercise Evaluation Guide, 24 Oct 2017.
[16] Eisler, C., et al., EXERCISE SALISH SEA 2017: Controller/Evaluator Handbook, 20 Oct 2017.
[17] Canadian Forces Warfare Centre, CFJP A2 Lessons Learned 1st Edition, (B-GL-025-0A2/FP-001), Apr 2015.
[18] DGNFD, Naval Orders – Royal Canadian Navy Lessons Learned Policy, (NAVORD 8010-1), Aug 2015.
[19] FEMA, Homeland Security Exercise and Evaluation Program (HSEEP) - Developing Exercise Evaluation Guides (online), https://preptoolkit.fema.gov/documents/1269813/1269845/EEG_Instructions_Developing_EEGs_Apr-13.docx/7895f678-a41c-4428-b16f-e084ce6ce6c4 (Accessed 18 October 2017), 2017.