UNIVERSITÀ POLITECNICA DELLE MARCHE

Dipartimento di Scienze della Vita e dell'Ambiente DISVA

**PHD COURSE IN LIFE AND ENVIRONMENTAL SCIENCES**

**Report Form for PhD student annual evaluation (XXXVI and XXXVII cycles)**

**Name of PhD student:** Lorenzo Biagini

**Title of PhD research:** Maxi Emergencies and Search and Rescue at sea

**Name of PhD supervisor:** Prof. Fausto Marincioni

**Research lab name:** Laboratory of Disaster Risk Reduction

**Cycle:**
[ ] XXXVI
[X] XXXVII

**PhD Curriculum::**
[ ] Marine biology and ecology
[ ] Biomolecular Sciences
[X] Civil and environmental protection

**DISVA instrumentation labs/infrastructure eventually involved in the project:**
[ ] Actea Mobile Laboratory
[ ] Advanced Instrumentation lab
[ ] Aquarium
[ ] MassSpec lab
[ ] MaSBiC
[ ] Simulation/informatics lab
[ ] Other. Please, indicate: .....

**ABSTRACT (1000 characters, including spaces):**

The concept of "Search and Rescue" was introduced following the Hamburg convention of 1979, with the intention of developing a S.A.R. (*Search and Rescue*) international maritime organization aimed at rescuing people in danger at sea. In Italy, the General Command of the Coast Guard Corps of Harbor Offices coordinates SAR activities through a "National Maritime SAR Plan", according to which search and rescue operations are defined as follows:
"Search": operation, usually coordinated by a central rescue center and supported by a local rescue center, which makes use of available personnel, and which is aimed to locate people in danger.
"Rescue": operation intended to recover people in danger, to provide them with first medical aid or other care they may need and to transport them to a safe place.
Despite huge progresses over time in terms of SAR approaches and methods, recent incidents, such as for example the Costa Concordia in Italy or the Rena in New Zealand, showed that things can still go wrong. Certain accidents, in an increasing complicated navigation industry (both in terms of new technologies and number of vessel traffic), require specific skills and knowledge on the part of the rescuers. In most countries, firefighters are dispatched to control fires aboard ships. However, due to a lack of adequate knowledge, skills and equipment, their actions are not always as effective, with sometimes catastrophic outcomes. As a result,

specially trained forces with dedicated equipment have been established in some parts of the world; these are called Maritime Incident Response Groups (MIRG).
The objective of my thesis is to develop multidisciplinary research to understand ways to enhance SAR activities at sea, and possibly define an overall model of emergency response providing MIRG support in Italy. Data collection will be performed by visiting SAR at sea centers in Northern Europe and by participating to drill and training exercise.

**Part 1. Scientific case of the PhD Research (2 to 3 pages, including figures)**

**- BACKGROUND**

Worldwide SAR protocols have been developed over the years as a result of drills and training that have led to the creation of Maritime Incident Response Groups (MIRG). In case of naval accidents, these MIRG purpose to help the crew on board of the ship in distress, supporting the operations to contain the accident. The goal is to avoid abandonment of the ship, allowing them to return to port where possible. This approach is innovative and far-sighted, possibly preventing environmental disasters (Nordstrom et al., 2016).
Over the last few years many activities on testing exercises were conducted all around Europe, with Finland and Netherlands leading the effort, including MIRG dedicated teams in the emergency planning phases.
A good example of this is the "Maritime Incident Response Group Netherlands (MIRG.NL)," which is based in Rotterdam and is specialized in ship firefighting. MIRG.NL is a composed by various partners, including the Dutch Coast Guard, the Rotterdam-Rijnmond Safety Region, the Port of Rotterdam, the Rotterdam-Rijnmond Fire Brigade, the Joint Fire Brigade and the Marine Fire Brigade.
In 2018, the NAMIRG (North Adriatic MIRG) project was born, with the aim to structure shared rescue procedures integrated into the European civil protection regulations, thanks to which Italian, Slovenian and Croatian firefighters were trained.
Apart from this initiative, however, no other actions have taken place to date in order to improve the operational response in the event of a significant maritime accident in our country.
All this despite some maxi emergencies, such as the sinking of the Costa Concordia (2012) or the fire of the Norman Atlantic (2014), have tragically shown how Italian preparation in the event of a maritime accident is probably too concentrated on the response phase, neglecting the others phases of the cycle of disasters, often with dramatic consequences.
The advantage of SAR conducted through MIRG is to support the crew of the ship in distress with the competences and knowledges of professional operators. The disadvantage of employing MIRG is the difficulties of integrating it with the ship crew including possible resistance of the Captain to accept an external support.
On this basis, this doctoral research project seeks to also clarify issue and potentials of SAR plans employing MIRG, define and strengthen the rules of engagement for these teams, and define a collaborative multi-team work environment bridging differences between the MIRG and the crew of the ship in distress.

**- SCIENTIFIC AIMS**

The theoretical framework for this research project is based on the fundamental assumption that Incidents on board of ships at sea can have devastating effects on the lives of the crew, passengers and the environment, therefore providing help to safely navigating a damaged ship to a port of refuge, where the incident can be resolved, is a more effective way to handle sea emergencies.
The main hypothesis I want to investigate is: "The professional background of actors in emergencies influence the efficiency of maritime SAR operations."
Such postulate is subdivided in the following three sub-hypothesis:
i) The interaction between the Captain of the distressed ship and the MIRG must be properly planned (i.e. the predisposition of the Captain to receive help from the MIRG determines the success of the operations).
ii) An effective MIRG team must be composed of a harmonized multi-disciplinary team.
iii) The MIRG works correctly if communication and protocols are shared.

Following are examples of research questions developed to test these hypothesis:
What is the current approach and SAR protocol?
Is the commander available to receive external support?
How the MIRG team should relate with the Ship Captain?
How kind of specializations should have a MIRG team?
Are the MIRG teams available to be coordinate by the hosting Ship Captain?
Which are the rules of engagement?
In which moment of the emergency the MIRG should be called?
Who have the authority to activate the SAR protocol onboard?

I am currently developing a research methodology to collect data from the field. For example, I will collect event reports, investigation activities on selected accidents, I will interview crew members and MIRG rescuers to get their opinion and experience to help me build a model for MIRG use in Italy.

**- WORKPLAN AND RESEARCH ACTIVITIES**

**WP 1. Objective.**

State of the art Search and Rescue activities at sea (a difficult environment to perform emergency management).
The bibliography review consolidates the theory that maritime SAR is one of the most complex activities in the field of search and rescue (Wang C., 2006). Behind this activity is essential to have a good planning, training, and consolidated rules of engagement.
That's been confirmed during the interview that I've conducted with SAR coordinator of Finnish Coast Guard who empathized the importance of a team trained and able to work in synergy with multiagency operators.
In this direction I would investigate how Italian SAR actors from different public agencies are able to work together during a stressful situation like a rescue operation at sea.

**Methods**.

Analysis of available scientific literature, on site visit of SAR operation centers, meetings with MIRG teams, participation to Sar drills and exercises.

**Expected/Obtained Results**.

Starting from an in-depth, comparative, and multiscale analysis of the available literature on SAR and MIRG operations implemented throughout the World, Europe and Italy, I expect to:

- Deepen the understanding of the most common issues of SAR procedures.
- Compare lesson learned around the world with particular focus on Europe and Italy.

The basic assumption of this PhD research project is trying to investigate how the correct application of disaster management can possibly mitigate the damage of a possible maritime accident, thanks to adequate planning and preparation in times of peace.

**WP 2. Objective.**

Study cases and methodology.

**Methods**.

My doctoral project is organized in six main phases:

1. Conceptual analysis of strategical approach to SAR, through which gathering documents for a better understanding of the international and national legal framework of SAR and MIRG response model.
2. Tactical and operation analysis, through which better understanding the problems faced by MIRG teams. Data will be gathered through interviews and questionnaires to MIRG crew members to capture individual knowledge. This part of the work will be carried out with the contribution of SAR experts of the Finnish (https://raja.fi) and Dutch (https://www.kustwacht.nl) Coast Guard, with whom a collaboration has been initiated and an on-site visit already planned.

A collaboration with Finnish Coast Guard was initiated in August 2022 and an interview with Dutch Coast Guard is planned during next months.

3. Capitalizing on my experience as a full time firefighter in the Port of Piombino, I will try to combine the results of this research project with the daily experience/best practices gathered with my work. The overall aim is provide support and guidelines the develop MIRG approach for SAR in Italy.
4. To this end a collaboration has been initiated with Galileo Search and Rescue (https://www.euspa.europa.eu/european-space/galileo/services/search-and-rescue-sar-galileo-service), the European Union Agency for the Space Programme (EUSPA), as well as with the Italian "Guardia Costiera" (https://www.guardiacostiera.gov.it/) to investigate their approach and SAR at sea procedures.
5. Maritime Rescue Congress in Rotterdam, next year. During this event I plan to collect data with questionnaires and interview to commanders and maritime crews about their emergency procedures onboard and how they evaluate the opportunity to receive help from a professional SAR team.
6. Multi agency exercise with the Corpo Nazionale Vigili del Fuoco and Guardia Costiera in Messina, this november, to test the deployment of the first Italian MIRG team. I'm involved as firefighter in the organization of this drill/exercise, and I plan to collect data during the operations activity. During the exercise I plan to collect data with field observation and interview to the actors involved, about the opportunity to work in a multiagency team involved in a maritime SAR operation.

**Expected/Obtained Results**.

- Contribute to update guidelines for effective SAR by using MIRG in Italy,
- Contribute to enhance MIRG planning,
- Develop a specific "**SAR management cycle**", namely starting from the fine-tuning of already existing models of "disaster cycle," over the four temporal phases: preparation; response; recovery; and mitigation. The first phase is that of "preparedness", which refers to the period prior to the crisis. Then there is the "response" phase which is followed, at a later stage, by the "recovery" phase. Finally, after some time from the event, there is the "mitigation" phase.
- Developing a good SAR management cycle would be an essential tool to help the various SAR actors to standardize joint procedures (e.g. training, communications, sharing of resources, etc.).

**- REFERENCES**


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**Part 2. PhD student information on the overall year activity (courses/seminars/schools, mobility periods, participation to conferences)**

***List of attended courses/seminars/schools***

- "Innovation and technology transfer" course Prof. Donato Iacobucci
- "Designing research: European projects" Prof. Nicola Paone
- Training for SAR operations 24/03/2022, Public Safety Communication Europe (PSCE)
- CORE - Resilience of the society: a global perspective 26/04/2022 (PSCE)
- Visit ad MRCC (Maritime Rescue Coordination Centre) of Italian "Guardia Costiera" (Roma), 08/08/2022
- Technical Training (72 hours - 3 CFU): Participation as firefighter at coordination of rescue activities for CON (Centro Operativo Nazionale) at Ministero dell'Interno (Roma)
- "Introduction to LaTeX environment for the editing of scientific documents" Prof. Spinozzi (in progress)
- "Theory and application of complex networks" Prof. Maria Grazia Ortore (in progress)
- Disaster Risk Management Training online series 2022, Coventry University (in progress)
- MIRG 2022 exercise: Participation as Phd student at rescue training activities on maritime SAR with multiagency teams (VF & CP) at Messina (in progress)
- Maritime Rescue congress 2023: Participation as Phd student at workshop activities about maritime SAR at Rotterdam-Netherlands (in progress)

***List of periods spent abroad***

- Visit at ERCC (Emergency Response Coordination Centre), Bruxelles (2023-in progress)
- Visit at headquarters of Finnish MIRG team, Helsinki (2023-in progress)
- Visit at International Maritime Rescue Federation, Rotterdam (2023-in progress)

***List of conferences/workshops attended and of contributions eventually presented***

- Presentation of a seminar on "Disaster risk reduction" at University of Pisa, A.A. 22/23 (in progress)

**Part 3. PhD student information on publications**

***List of publications on international journals*** None.

***List of publications on conference proceedings*** None.

***List of other publications (books, book chapters, patents)***

Biagini L., Casareale C., Kendra J., Marincioni F., "Fiction or reality? How social perception fosters myths of emergency management at sea" (2022), in preparation.

13/10/2022

Student signature

Supervisor signature