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 (XXXVII and XXXVIII 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:
[X] XXXVII
[ ] XXXVIII

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", which defines such operations as follows:
"Search": operations aimed to locate people in danger, coordinated by a central rescue center and implemented by a local teams which makes use of available personnel.
"Rescue": operations carried out to recover people in danger, provide them with first medical aid or other necessary care, including transportation to a safe place.
Despite huge progresses over time in terms of SAR approaches and methods, incidents still happen, see for example the Costa Concordia in Italy or the Rena in New Zealand. In an increasing complicated navigation industry (both in terms of new technologies and number of vessel traffic), SAR requires specific skills and knowledge. 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 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 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 teams purpose to help the crew on board of the ship in distress, supporting the operations to contain the accident. The overall goal is to avoid abandonment of the ship, and when possible to return it to port. This approach is innovative and has the potential to lower environmental disasters (Nordstrom et al., 2016).
Over the last few years many at sea drills and testing exercises were conducted all around Europe, with Finland and the Netherlands leading the effort, also in terms establishing and supporting MIRG. For example the "Maritime Incident Response Group Netherlands (MIRG.NL)," based in Rotterdam and specialized in ship firefighting, is a good example of such an interagency effort. MIRG.NL includes 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 North Adriatic MIRG (NAMIRG) project was created, with the aim to define shared rescue procedures to be integrated into the European civil protection regulations. Italian, Slovenian and Croatian firefighters were involved. Yet, no concrete results have been achieved, and to date no actions have been undertaken to improve the operational response in the event of a significant maritime accident in our country. All this despite a few serious emergencies developed in our seas, such as for example the sinking of the Costa Concordia (2012) or the fire on the Norman Atlantic (2014); these disasters have tragically shown that in the event of a maritime accident, emergency management activities in Italy are mostly concentrated on the response phase, neglecting the others phases of the cycle of disasters.
A MIRG approach has its set of advantages and disadvantages. For example, SAR activities conducted through MIRG readily brings support to the crew of the ship in distress with the needed competences and knowledges. On the contrary, bringing a MIRG onboard might stirr conflicts with the ship's crew, including possible resistance of Captain to accept an external support.
On this basis, this doctoral research project seeks to 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 safely navigating a damaged ship to a port of safe harbor, 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 the various figures involved in the emergency influences their ability to coalesce into a multidisciplinary team capable to efficiency perform 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 is composed of properly complemented multi-disciplinary expertise.
iii) Shared communication protocols are pivotal for a successful MIRG approach.

Following are examples of research questions developed to test these hypotheses:

- What is the current maritime SAR approach and protocol?
- Is the commander inclined to receive external support?
- Are the MIRG available to be coordinate by the hosting Ship Captain?
- Are the rules of engagement clear and accepted by both (MIRG and Ship Captain)?
- Does the MIRG have the authority to activate SAR protocols onboard?
- What kind of specializations should be included in a MIRG?

To gather the information necessary to answer the above research questions both qualitative and quantitative methodologies will be used. For example, collection of technical event reports, investigation of emergency activities on selected accidents, as well as interviews to Ship Captains, crew members and MIRG rescuers. Moreover, I am also actively participating to meetings of the ShipMaster/Captain association (Unione Sindacale Capitani di lungo Corso al Comando) to evaluate their approach to SAR.
Finally, I am participating both as professional firefighter and as researcher in the design and implementation of the three maritime emergency drills: a) firefighting on board of a ship in distress; b) transport firefighter from the harbour to the ship in distress; c) multiagency rescue at the ship in distress with patrol boat and helicopter from Fire fighter and Coast Guard. These exercises will be very important data sources for my doctoral project. I am focusing in collecting data on the following phases of the exercises: 1, 2,3, etc.

- 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 consolidated the fact that maritime emergencies are among the most complex scenario in the field of search and rescue (Wang C., 2006), and that to enhance SAR at sea it is essential to have good planning, training, and consolidated rules of engagement. This initial phase of the research has enable me to define a conceptual scheme to effectively analyze strategical approaches to SAR, through which design a methodology to properly gather documents for a better understanding of the international and national legal framework of maritime SAR and MIRG response model.

Methods.

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

Expected/Obtained Results.

A comparison of the available scientific and technical literature on MIRG operations carried out in different contexts Worldwide, and with particular attention to those in Europe and in Italy, I expect to:

- Deepen the understanding of the most common issues of SAR procedures.
- Highlight lessons learned particularly in Europe and Italy.

WP 2. Objective.

Hypothesis, study cases and methodology.

Methods.

In addition to the initial literature review, which enabled me to define the theoretical framework, my doctoral project is organized in five main phases:

1. Tactical and operation analysis, through which better understanding the problems faced by MIRG. Data will be gathered through interviews and questionnaires to MIRG crew members to capture individual knowledge. This part of the work has been 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 done in June 2023.

2. Capitalizing on my experience as a full time firefighter in the Port of Piombino, I am trying to combine the results of this research project with the daily experience/best practices gathered with my work. The overall aim is to provide support and guidelines the develop MIRG approach for SAR in Italy.
3. 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.
4. Maritime Rescue Congress in Rotterdam, June 2023. During this event I worked 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.
5. Multi agency exercise is planning. After the first training in June 2023 with an exercise focused at firefighting on board of a ship in distress we are now working about the organization of a training about the transport of firefighter from the harbour to the ship in distress.

   At last, I am working on the preparation of an exercise with the Corpo Nazionale Vigili del Fuoco and Guardia Costiera of Livorno (2024) to test the deployment of a pilot Italian MIRG. During the exercise I plan to collect data with field observation and interview to the various actors involved in the operations. Particular attention will be paid on the interoperability of a multiagency team carrying out maritime SAR operations.

Expected/Obtained Results.

- Contribute to **update guidelines for effective SAR by using MIRG in Italy**,
- Contribute to enhance **overall MIRG planning**,
- Develop a specific "**SAR management cycle**", namely starting from the fine-tuning of already existing models of "disaster cycle." Developing a good SAR management cycle would be an essential tool to help the various maritime SAR actors to standardize joint procedures (e.g. training, communications, sharing of resources, etc.).

WP 3. Objective.

Understand how MIRG team works during a stressful situation like a rescue operation at sea and how they collaborate with other organizations and with the crew of the ship in distress.

Methods.

On site visit at MIRG firehouse (located in Rotterdam & Helsinki), interview and questionnaires with the rescue teams, participation to Search & Rescue exercises during the World Maritime Rescue Congress.

Questionnaires has been administered using the Likert scale that typically provides five possible answers to a statement or question that allows respondents to indicate their strength from positive to negative agreement regarding the question or statement.

Qualitative interviews have been conducted to acquire in depth perspectives and stance on the subject of maritime SAR of the participant.

Expected/Obtained Results.

The collected information should help me to better:

- Understand relationship between Master/Captain and rescue team during an emergency,
- Start a collaboration with Master Corporation,
- Project a new MIRG procedures in Italy,
- Compare operations and rescue approaches,

The goal of this work packages is to understand how to harmonize MIRG and the crew of the ship in distress.

- REFERENCES

Alexander, D. (2000), *Confronting Catastrophe,* Oxford, Oxford University Press.

Armstrong, J. G. (2002), *The Halifax explosion and the Royal Canadian Navy,* Vancouver, Toronto.

Capt. Messer-Bookman, T. (2015), *Maritime casualties,* Atglen, Schiffer.

Caragliano, S. (2007), *Società e disastri naturali. La vulnerabilità organizzativa nelle politiche di prevenzione dei rischi*, Bologna, Pitagora.

Catino, M. (2006), *Da Chernobyl a Linate. Incidenti tecnologici o errori organizzativi?,* Milano, Mondadori.

Chelminski, R. (1987), *Superwreck. Amoco Cadiz: the shipwreck that had to happen,* New York, William Morrow.

Cianciotta, S.M. (2015), *Organizzare e comunicare l'emergenza nella PA,* Santarcangelo, Maggioli.

Douglas, M. & Wildavsky, A. (1983), *Risk and culture*, Berkeley, University of California Press.

Gill, G.W. (2011), *Maritime error management*, Atglen, Schiffer

Jebb, A., Ng V. & Tay L. (2021), *A review of Key Likert Scale Development Advances: 1995-2019,* Frontiers in Psychology.

La Torre, U. (2018), *Le anomalie nel comando della nave: considerazioni sui casi Segesta Jet e Costa Concordia,* in "Il Diritto Marittimo", pp. 837-876.

Ligi, G. (2016), *Percezioni di rischio. Pratiche sociali e disastri ambientali in prospettiva antropologica*, Padova, Cleup.

Ligi, G. (2009), *Antropologia dei disastri,* Bari, Laterza.

Marotta, N. & Zirilli, O. (2015), *Disastri e catastrofi,* Santarcangelo, Maggioli

Nordstrom, J., Goerlandt, F., Sarsama, J., Leppanen, P., Nissila, M., Ruponen, P., Lubcke, T., Sonninen, S. (2016), *Vessel TRIAGE: A method for assessing and communicating the safety status of vessels in maritime distress situations,* Elsevier.

Perry, W.R. & Quarantelli, E.L. (2005), *What is a disaster?*, Bloomington, Xlibris.

Pitzalis, S (2012), *Lineamenti di antropologia dei disastri,* in "Resoconto annuale del progetto di Dottorato in Storia, XXVII ciclo", pp. 3-15.

Perry, W.R. & Quarantelli, E.L. (2005), *What is a disaster?*, Bloomington, Xlibris.

Prince, S.H. (1920), *Catastrophe and social change. Based upon a sociological study of the Halifax Disaster,* New York, Columbia University.

Rossi, S. (2015), *Il naufragio della Costa Concordia: norme incriminatrici e categorie dogmatiche alla prova dei fatti (una prima lettura),* in "Diritto Penale Contemporaneo".

Saitta, P. et al. (2015), *Fukushima, Concordia e altre macerie,* Firenze, Edit.

Tasca, L. (1990), *The social construction of human error*, Ann Arbor, UMI.

Turner, B. & Pidgeon, N.F. (2001) *Disastri. Dinamiche organizzative e responsabilità*, Milano, Ed. Co.

Vaughan, D. (2015), *The challenger launch decision,* Chicago, UCP.

Wang, C. (2006), *Principles and practices towards SAR services: a comparative study on states' approaches to improving maritime SAR*, World Maritime University, Malmo.

Zunarelli, S. & Comenale Pinto, M. (2016), *Manuale di diritto della navigazione e dei trasporti,* Padova, CEDAM.

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 (2022 – 2 CFU)
- "Designing research: European projects" Prof. Nicola Paone (2022 – 2 CFU)
- "Introduction LaTeX for the editing of scientific documents" Prof. Francesco Spinozzi (2022 – 1 CFU)
- "Theory and application of complex networks" Prof. Maria Grazia Ortore (2022 – 1 CFU)
- "Climate-related risks and extreme events" Prof. Pierpaolo Falco (2023 – 1 CFU)
- "Methods of Disaster Research" Prof. Fausto Marincioni (2023 1 - CFU)
- Training for SAR operations, Public Safety Communication Europe – PSCE – (2022 – 0.5 CFU)
- CORE - Resilience of the society: a global perspective - PSCE - (2022 – 0.5 CFU)
- Visit at MRCC (Maritime Rescue Coordination Centre) of Italian "Guardia Costiera", Roma (2022 – 1 CFU)
- Technical Training (72 hours - 3 CFU): Participation as firefighter at coordination of rescue activities for CON (Centro Operativo Nazionale) at Ministero dell'Interno, Roma (2022 – 3 CFU)
- Disaster Risk Management Training online series, Coventry University (2022 – 8 CFU)
- Technical Training (48 hours - 6 CFU): Participation as firefighter at European training "Roma 2023" at Scuola Formazione Operativa VV.F. at Ministero dell'Interno, Roma (2023 – 6 CFU)
- Firefighting exercise: Participation as Phd student at rescue training activities on maritime SAR with multiagency teams (VF & CP), Piombino (2023 – 1 CFU)
- Maritime Rescue congress 2023: Participation as Phd student at workshop activities about maritime SAR at Rotterdam-Netherlands (2023 – 1 CFU)
- "Human rights standards in Disaster settings" Intensive Course at Sant'Anna Pisa (2023 - 4 CFU)
- MIRG 2024 exercise: Participation as Phd student at rescue training activities on maritime SAR with multiagency teams (VF & CP) at Livorno (2024-in progress)

List of periods spent abroad

- Visit at headquarters of Finnish MIRG team, Helsinki (April 2023 – 1 CFU)
- Visit at International Maritime Rescue Federation, Rotterdam (June 2023 – 1CFU)
- Visit at headquarters of Dutch MIRG team, Port of Rotterdam (June 2023 – 1 CFU)

- Visit at Rotterdam 112 Response Center, Port of Rotterdam (June 2023 – 1 CFU)
- Visit at Galileo SAR Operational Center, EU Commission Bruxelles (June 2023 – 1 CFU)
- Visit at ERCC (Emergency Response Coordination Centre), Bruxelles (2024-in progress)
- Visit at headquarters of Swedish MIRG team, Stockholm (2024-in progress)
- Visit at Research Institute of Sweden, Goteborg (2024-in progress)
- Visit at EMSA (European Maritime Safety Agency), Lisbon (2024-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 (1 CFU)
- Presentation of a seminar on "Disaster risk reduction" at University of Pisa, A.A. 23/24 (in progress)
- Presentation of a seminar on "Disaster risk reduction" at University of Verona, A.A. 23/24 (in progress)
- Presentation of a seminar on "Disaster risk reduction" at University of Bergamo, A.A. 23/24 (in progress)

Part 3. PhD student information on publications

List of publications on international journals None.

List of publications on conference proceedings None.

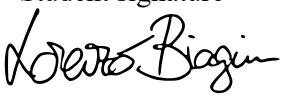
List of other publications (books, book chapters, patents)

Biagini L., Casareale C., Kendra J., Marincioni F., "Fiction or reality? How social perception fosters myths of emergency management at sea" (2023), in preparation.

Biagini L., "Disastri, percezione del rischio e vulnerabilità sociale" (2023), in preparation.

13/10/2023

Student signature



Supervisor signature