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IEA Vice-President & Treasurer

**Third International Conference Ergo-2018: Human Factors in
Complex Technical Systems and Environments**





Emergency Response Management

Reflections on Work As Done (WAD) and Work As Imagined (WAI) in an emergency response organization: a study on firefighters training exercises



Управление аварийным реагированием

Размышления о работе как выполненные (WAD) и работа как предполагаемые (WAI) в организации реагирования на чрезвычайные ситуации: исследование по тренировкам пожарных

Motivation



Rio de Janeiro's
Mountain Disaster,
2011
> 1,000 deaths





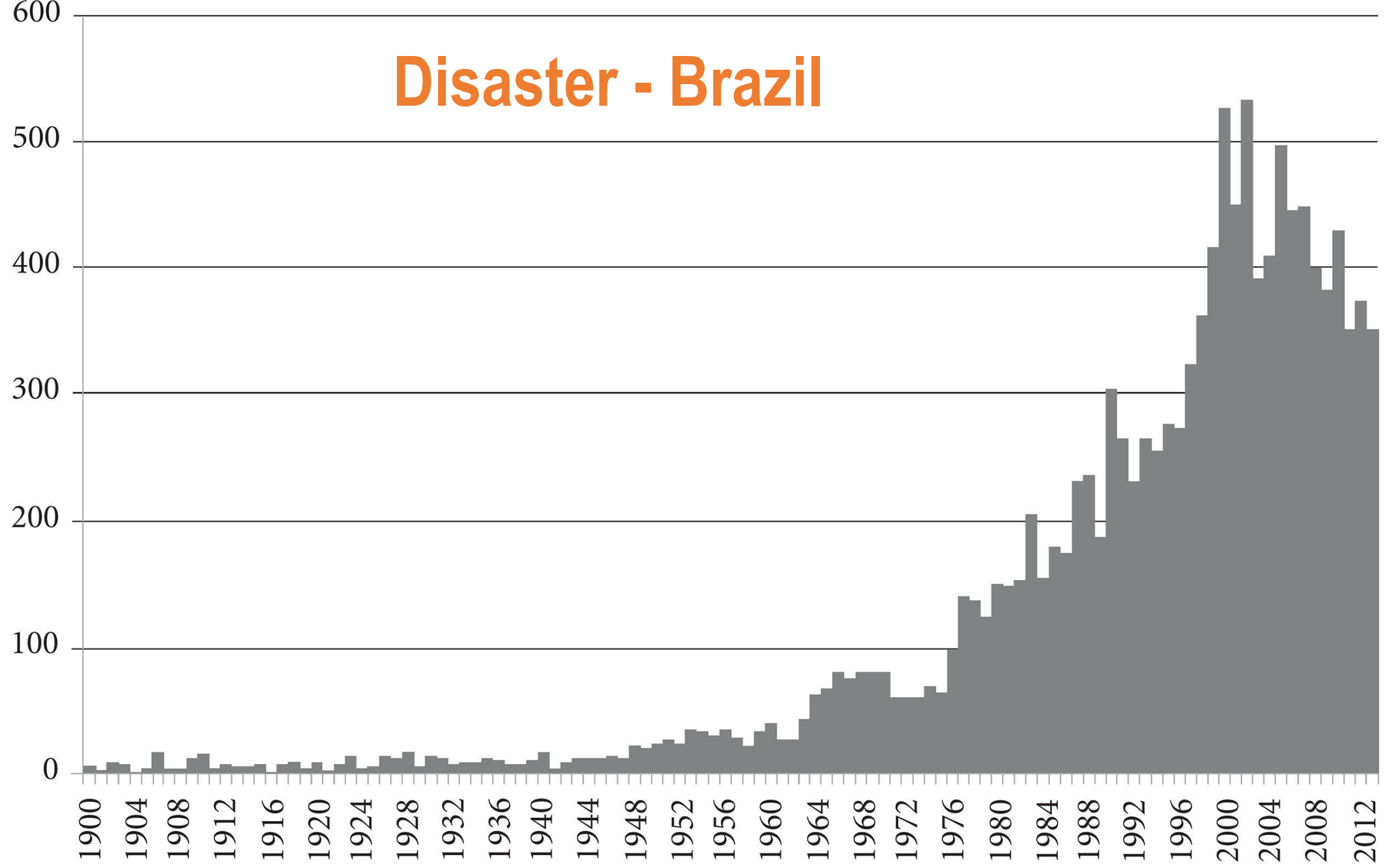


MARIANA — MINAS GERAIS (2015)



Disaster - Brazil

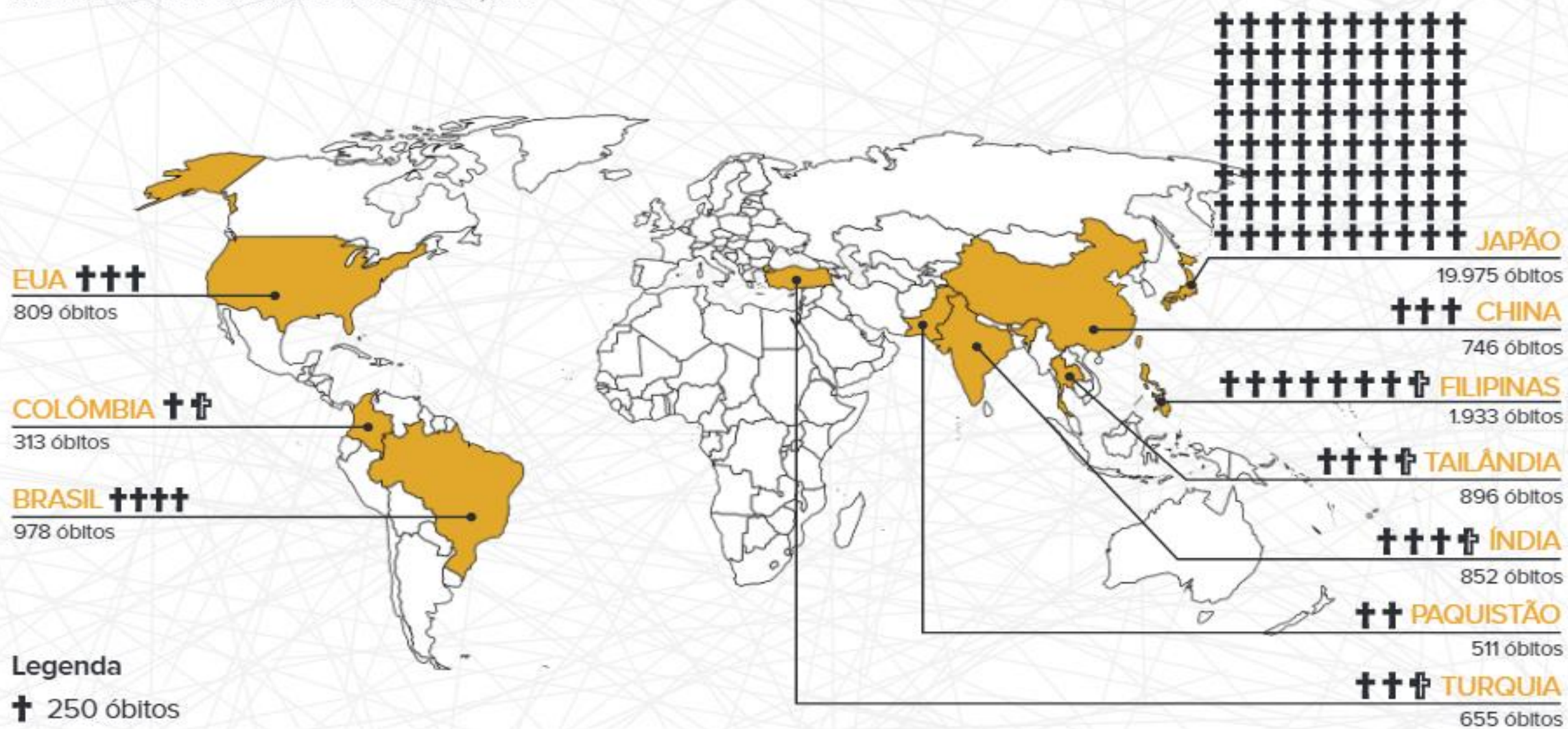
Número de desastres



Ano

RANKING DOS DEZ PAÍSES COM MAIOR REGISTRO DE ÓBITOS EM DESASTRES EM 2011

DADOS APROXIMADOS BASEADOS NO EM-DAT, 2012



Impacts of Disasters since the 1992 Rio de Janeiro Earth Summit

In 1992, the United Nations organized a conference on environment and development in Rio de Janeiro, called the Earth Summit. The purpose of the conference was to rethink economic growth, advance social equity and ensure environmental protection.

Twenty years later, the UN is organizing Rio+20, a chance to move away from business-as-usual and to end poverty, address environmental destruction and build a bridge to the future. Disaster risk reduction (DRR) plays an important part in this future of sustainable development.

Here's a look at the impact of disasters since the Earth Summit (1992-2012).



The United Nations Office for Disaster Risk Reduction

<http://www.unisdr.org>

Version: 14 December 2012

DATA SOURCES

EM-DAT: - <http://www.emdat.be/>: The OFDA/CRED International Disaster Database; Data version: 11 June 2012 - v12.07; Disasters: Natural Disasters as categorized in EM-DAT; Affected: The sum of injured, homeless, and people requiring immediate assistance during a period of emergency - it can also include displaced or evacuated people from disasters; Damage: Estimated figures; Killed: Persons confirmed as dead and persons missing and presumed dead.

¹ UN Stats - <http://unstats.un.org>: Estimated mid-year world population for 2010 is 6.9 billion.

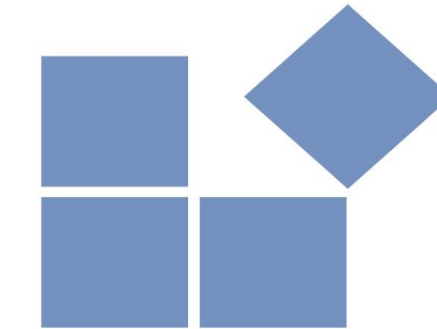
² OECD - <http://stats.oecd.org>: ODA from 1986-2010 totals approximately USD1.7 trillion.

³ Boeing 747 - <http://goo.gl/s5ea2>: Typical 3-class passenger capacity is 416.



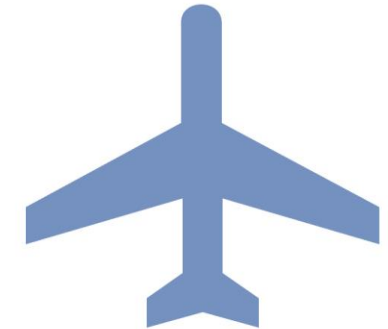
4.4
BILLION
AFFECTED

Equal to 64% of the world's population¹.



\$2.0
TRILLION
DAMAGE (USD)

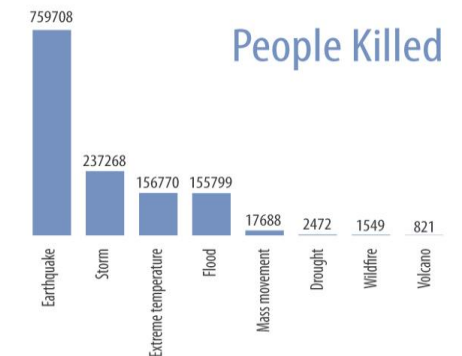
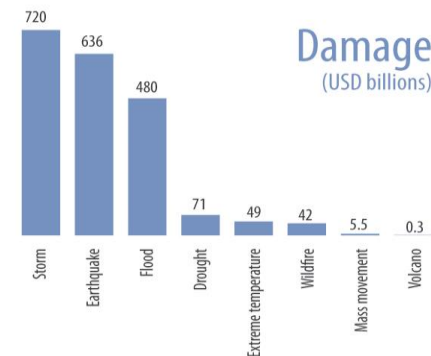
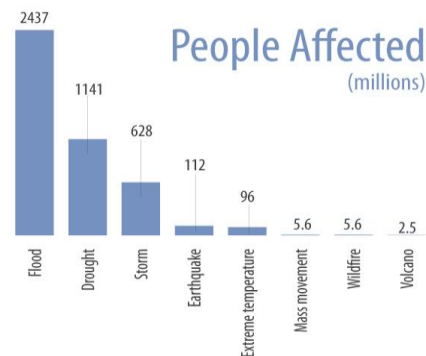
Similar to 25 years of total Overseas Development Aid².



1.3
MILLION
KILLED

Comparable to 3125 jumbo jets³.

Impact by disasters



Impact by top 10 countries

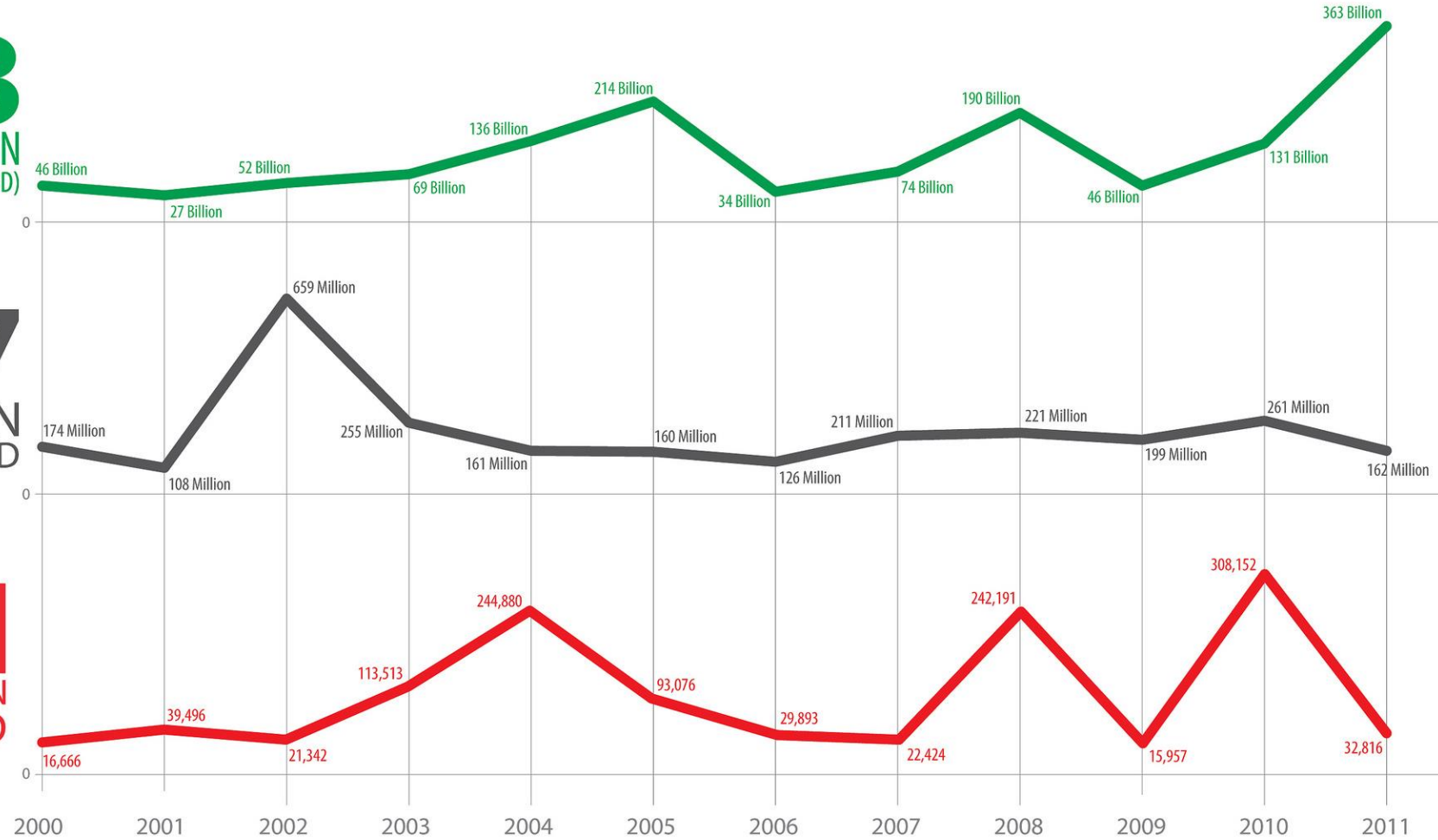


The Economic and Human Impact of Disasters* in the last 12 years

\$1.3 TRILLION
DAMAGE (USD)

2.7 BILLION
AFFECTED

1.1 MILLION
KILLED



*Disasters refers to Natural Disasters as categorized in EM-DAT
 Data source: EM-DAT: The OFDA/CRED International Disaster Database
 Data version: 10 January 2012 - v12.07
 Humanitarian Symbol Set (2008): <http://www.ungisw.org/map/guideline.php>

KEY
DISASTER
EVENTS

- South Asia July 2002
- Europe Aug 2002
- China Aug 2002

Indian Ocean Dec 2004

Bam (Iran) Dec 2003

Kashmir Oct 2005

Katrina Aug 2005

Sidr Nov 2007

Sichuan May 2008

Nargis May 2008

Pakistan July 2010

Haiti Jan 2010

Japan March 2011

Multidisciplinary research team

- José Orlando Gomes (DEI/POLI) – D.Sc. UFRJ, Brazil & CNAM/Paris
- Paulo Victor Carvalho (IEN) – D.Sc. UFRJ
- Marcos Borges (DCC/IM) - PhD East Anglia, UK
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- Jonice Oliveira (DCC/IM) - D.Sc. UFRJ
- Giseli Lopes (DCC/IM) – D.Sc. UFRGS

Areas of Interest



- **Emergencies**
- **Computer Supported Cooperative Work (CSCW) – Prof. Liam Bannon**
- **Resilience Engineering – Prof. Erik Hollnagel**
- Social Networks Analysis
- Business Intelligence
 - Mobile Devices
 - Knowledge Management
 - LOD
 - Semantic Web and Ontologies
 - Information Recovery and Visualization

UNDERPINNING

Cognitive Ergonomics
Resilience Engineering

METHODS

Ethnography
Cognitive Task Analysis/Cognitive
Work Analysis

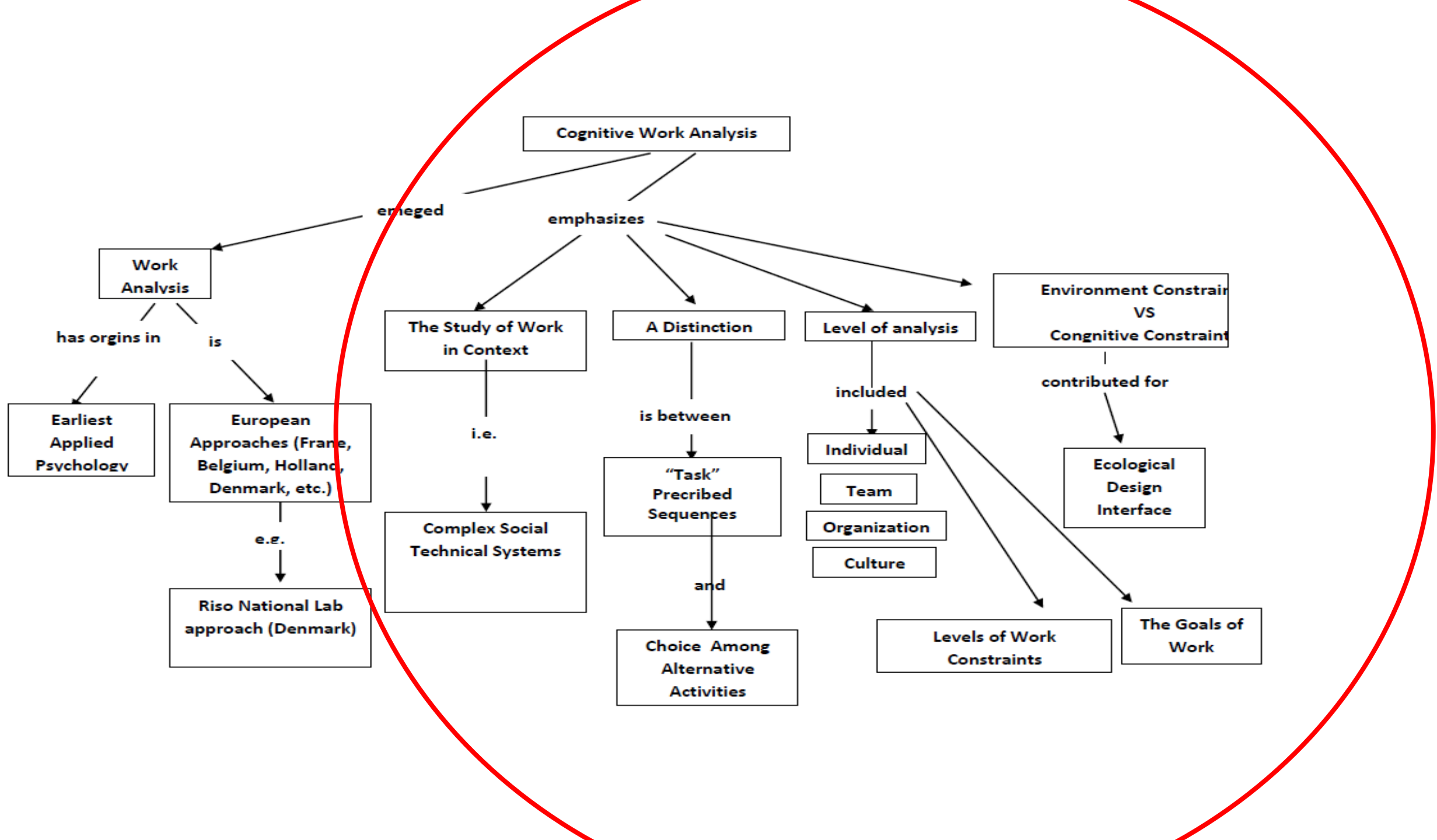
AREAS OF WORK

Complex Systems
Petrochemical Industry
Nuclear Industry

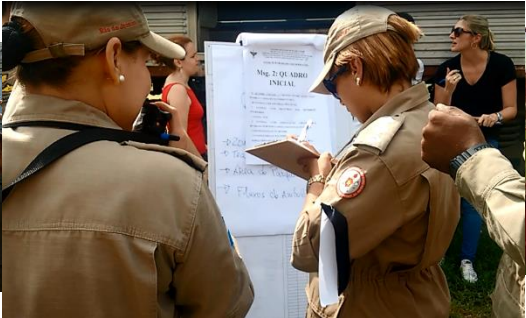
Sectors of Government – Public Security/Emergency Response

APPROACH

Emergency Management Systems
Factors Promoting Resilience and Brittleness
Characteristics of Complexity
Aspects of Collaborative Work
Learning



RESEARCH



Emergency Response Simulation Exercises

- Participation in 3 simulation exercises
 - Part of one of the subjects of the firefighter preparation course (from Captain to Major)
- Objectives of the exercises
 - Get officers to experience more closely real situations they will face after their training for promotion (from Captain to Major)
 - Verify knowledge of, use of, and appropriateness of a standard operational procedure (POP) related to management of operational events, especially long lasting and complex ones
- Types of exercise
 - Functional Exercises – november.2015 – Escola Superior do Corpo de Bombeiros (Firefighting Academy)
 - Tabletop – november.2014 and june.2015 - CICC

Research Environment

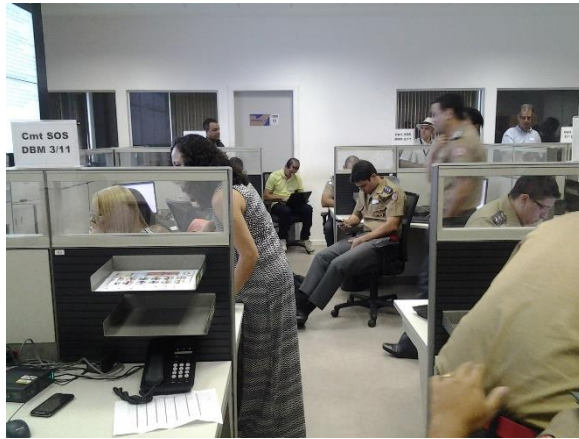
- Rio State's Integrated Command and Control Center



- Rio de Janeiro's Firefighting Corps




November.2014 Simulation



November.2015 Simulation

- Student Preparatory Exposure
 - Site visit
 - Study the exercise's characteristics
 - Discuss the adjustments with the facilitator
 - Participation in theory classes related to the subject



 GOVERNO DO ESTADO DO RIO DE JANEIRO SECRETARIA DE ESTADO DE DEFESA CIVIL CORPO DE BOMBEIROS MILITAR DO ESTADO DO RIO DE JANEIRO ESCOLA SUPERIOR DE COMANDO DE BOMBEIRO MILITAR CURSO DE APERFEIÇOAMENTO DE OFICIAIS / QOC - 2015 EXERCÍCIO BASEADO EM OPERAÇÕES						
INSTITUIÇÕES	I GBM	DBM 1/I	DBM 2/I	II GBM	COCBMERJ	
Papéis	- Cmt Socorro - Chefe SOP ABS 014 AT 005 USB 188 AR 224 ASE 270	- Cmt DBM (Socorro) ABS 007	- Cmt DBM (Socorro) APM 07 USB 149 AR 235 USB 147 BI 002	- Cmt Socorro - Chefe SOP ATE 012 USB 156 AT 081 USB 151 AT 081	ACOMPANHANTE DO DIRETOR DE OPERAÇÕES APC 001	
EFEITOS	<p>Na pessoas: Lesões físicas, óbito e pânico generalizado.</p> <p>Na bens e serviços: Destruição dos bens materiais e falhas nos serviços prestados.</p> <p>Na mobilidade urbana: Impedimento de fluxo de veículos, congestionamentos.</p> <p>Em outras agências: Impacto na segurança pública (PMERJ) e Impacto na qualidade do ar e da água (INEA, FEEMA)</p>					

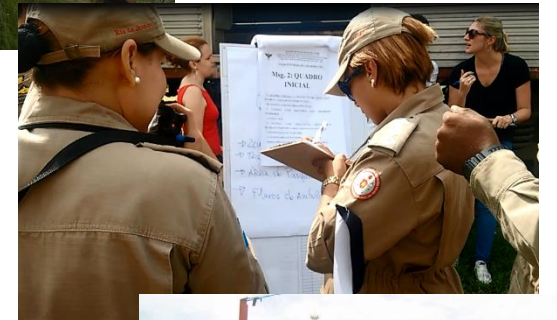
November.2015 Simulation


- Exercise preparation
 - Assemble the resources for data collection
 - 20 researchers
 - 12 cameras
 - 15 voice recorders
 - 1 drone
 - Identify the teams
 - Hand over the voice recorders and radios
 - Set up the cameras
 - Observation Instructions



November.2015 Simulation

- The simulated exercise
 - 40 participants
 - 8 groups
 - 5 teams in the field
 - 3 command and control teams
- Briefing
 - Undertaken in a classroom by the facilitator with participants
- Exercise
 - Approximately 1h of activity in the field
- Debriefing
 - Approximately 30min of discussions about the main points in a classroom setting



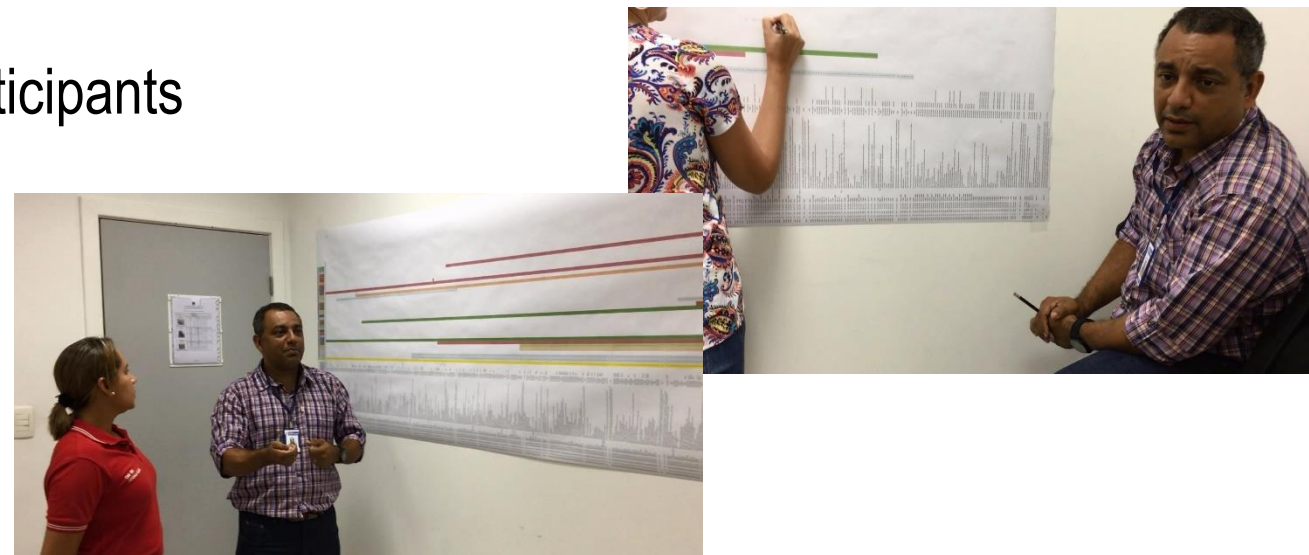
A man with a mustache and glasses, wearing a blue and white striped shirt, is looking upwards. The background shows a grassy field with red poles, possibly a sports field or training area. There are some people in the distance. The text is overlaid on the image.

Simulado de Emergência
Corpo de Bombeiros do Rio de Janeiro
19 de Novembro de 2015
Universidade do Corpo de Bombeiros

November.2015 Simulation

- Analysis of the data
 - Transcription of the audio recordings
 - Merge into a single spreadsheet
 - Analysis of the video recordings
 - Analysis of the observation reports
- Validation by/with the facilitator & participants
 - Main insights

Família de Origem		POP 0		GBM1		DBM2/3	
Minuto	Equipe	Fala	Via de comunicação	Pessoa	Prese	Prese	Prese
P2 211	00:33:23	DBM 2/I					
P4 190	00:33:24	Rádio					
P4 191	00:33:29	DBM 1/I					
P7 67	00:33:31	II GBM					
P2 213	00:33:34	DBM 2/I					
P4 193	00:33:38	DBM 1/I					
P4 194	00:33:40	DBM 1/I					
P7 70	00:33:45	II GBM					
P2 215	00:33:46	DBM 2/I					
P6 201	00:33:52	Sop II GBM					
P2 216	00:33:54	DBM 2/I					
P2 217	00:33:56	DBM 2/I					
P2 218	00:33:59	DBM 2/I					
P2 220	00:34:03	DBM 2/I					
P4 196	00:34:03	DBM 1/I					
P4 197	00:34:05	DBM 1/I					
P1 55	00:34:06	I GBM					
P1 56	00:34:09	I GBM					



November.2015 Simulation

- Articles in the works
 - Analysis of prescribed versus real work
 - Standardization – SOP stages
 - Actions and decisions during the exercise
 - Analysis of resilience
 - Evidence of resilience and brittleness in actions
 - Analysis of collaboration
 - Aspects of communication, coordination and cooperation

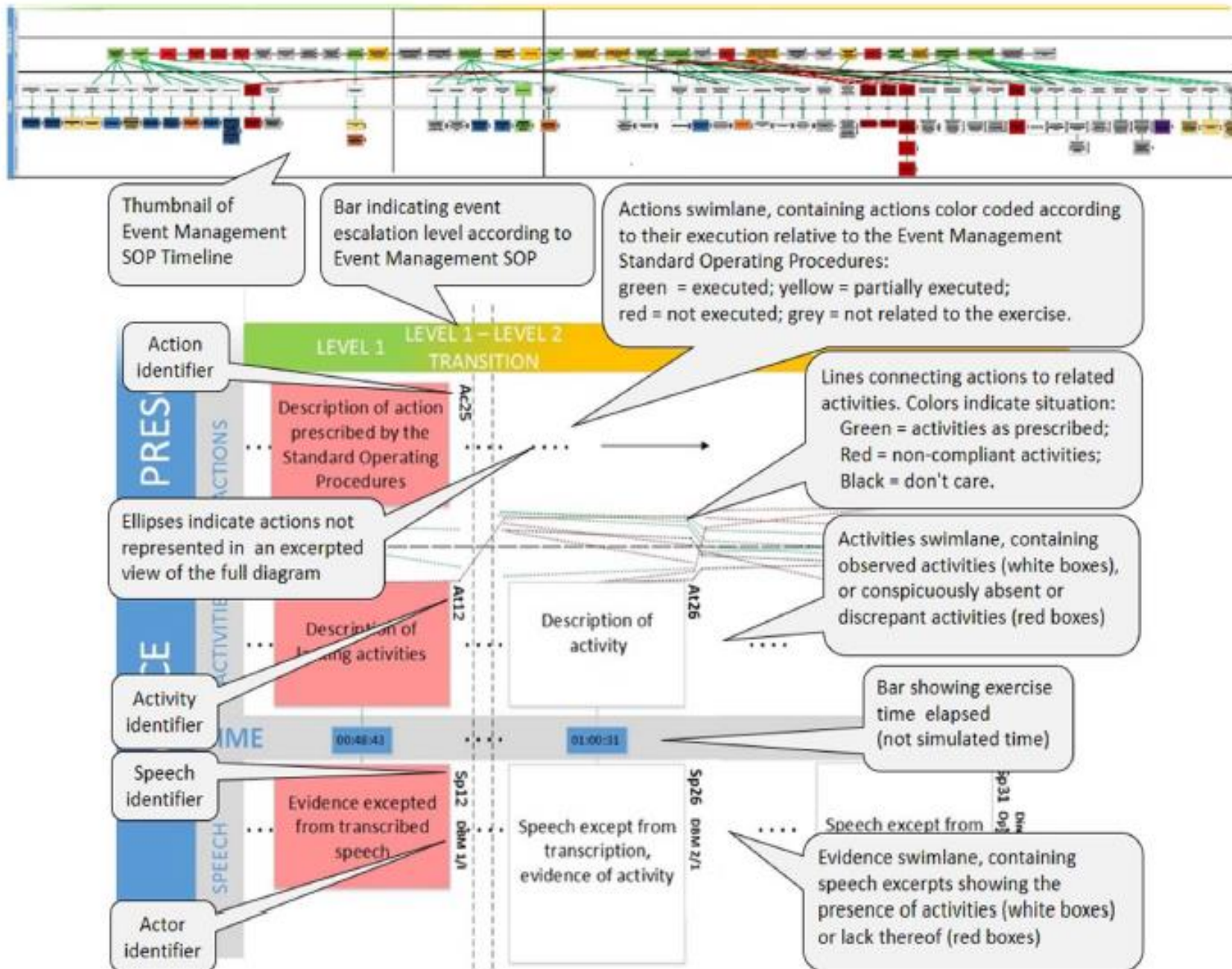


Fig. 1. The event management SOP TimeLine - EMSTL.

SOP steps and their execution. Key: (D) Done; (PD) Partially Done; (ND) Not Done; (NA) Not Applicable.

SOP Steps	Status*	Evidence	Considerations	
Level I procedures	Assessing the site to establish the need for operational support	D	First responder assess the site and relay information on the victims. COCBI requests info as well.	At this early step, only the COCBI and DIRM I/I take part in the assessment. The team calls for backup first and only then relays information on the situation at the site.
	Calling for backup	D	DIRM I/I requests operational support from the COCBI ("Bravo Zero Zero" in radio jargon), which contacts other teams and issues calls for backup.	Messages show a messaging pattern. The COCBI advises on the event and dispatches response vehicles. Lack of control of resources at the site, considering no one makes notes on that.
	Defining a Reference Vehicle.	ND	There were no clear messages about a reference vehicle (RV) being defined.	There are calls asking for vehicles and confirming they were on their way; however, it is not clear whether a RV had been defined. Even officers are unsure which vehicle is the RV.
	Setting up first aid in a safe place, and defining the hot, warm, and cold areas.	ND	This step was not mentioned during the exercise.	This step was not mentioned during the event's level I.
	Along with the teams involved, defining the incoming and outgoing routes for operational and support vehicles	ND	This step was not mentioned during the exercise.	None of the teams mentioned possible travel routes. This may have been due to the absence (notional status) of the vehicles.
	Closing off the event area and restricting the access of people foreign to the Fire Dept.	ND	This step was not mentioned during the exercise.	The only mention to this step was a comment by GHM I pointing out the need to evacuate the site when the media is in the area.
	Handing out two-way radios to teams according to the operational tactic employed	NA	Not applicable to the proposed exercise.	The teams were given their radios beforehand, prior to the simulation briefing.
	Making sure all firefighters in the hot area wear Personal Protective Equipment (PPE)	NA	Not applicable to the proposed exercise.	There is no PPE available to be worn in the simulation. Danger areas were not defined in the field.
	Setting operational cycles, if applicable, and drawing up all necessary plans	NA	This step was not mentioned during the exercise.	The estimated emergency response activity would not be long enough to justify setting up operational cycles, due to nature of the simulated accident.
	Clearing out streets as quickly as possible to keep disruptions for the population to a minimum	NA	Not applicable to the proposed exercise.	Although consequences of the accident on traffic featured in the event's escalation (3 cars and a bus on fire), clearing streets and managing traffic were beyond the scope of the simulation.
Level II procedures Transition between levels	Keeping the COCBI up to speed on the event and possible negative developments	D	The teams often reported on the situation of new victims to the COCBI and their transportation to the nearest hospital.	Information on victims and resources in the field is exchanged throughout the exercise. However, several times there were information discrepancies between the teams and those managing the event.
	Applying technical and tactical measures acquired during training while handling the event response	PD	Application of some technical and tactical measures was observed.	As the exercise progressed, it was hard to verify all pertinent technical and tactical actions were being carried out.
	Preserving the Fire Department's operational power by releasing no longer needed human and material resources from the response site.	NA	Not applicable to the proposed exercise.	The exercise escalated to another level, therefore the activities had not ended and resources could not have been demobilized.
	Making sure the demobilization takes place in a consistent manner to prevent rework in case the event does not evolve or else call for an escalation to level II	NA	Not applicable to the proposed exercise.	The exercise escalated to another level, therefore the activities had not ended and resources could not have been demobilized.
	Receiving the Operations Coordinator/Squad Commander of the operational area where the	D	COCBI instructs the teams to relay information to the ADO at	The ADO's arrival signals the event has escalated and represents the SOP-prescribed

WAI X WAD

Scalation: management level changing failure

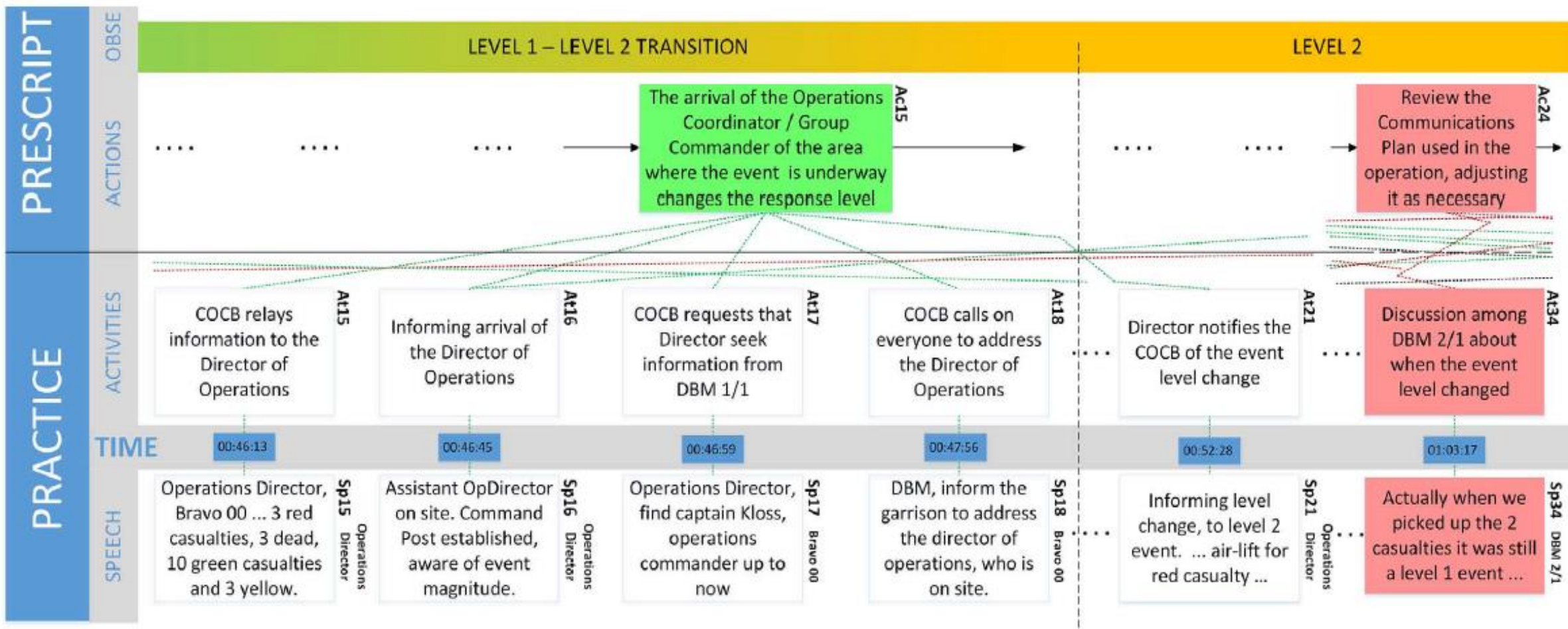


Fig. 8. Event response escalation.

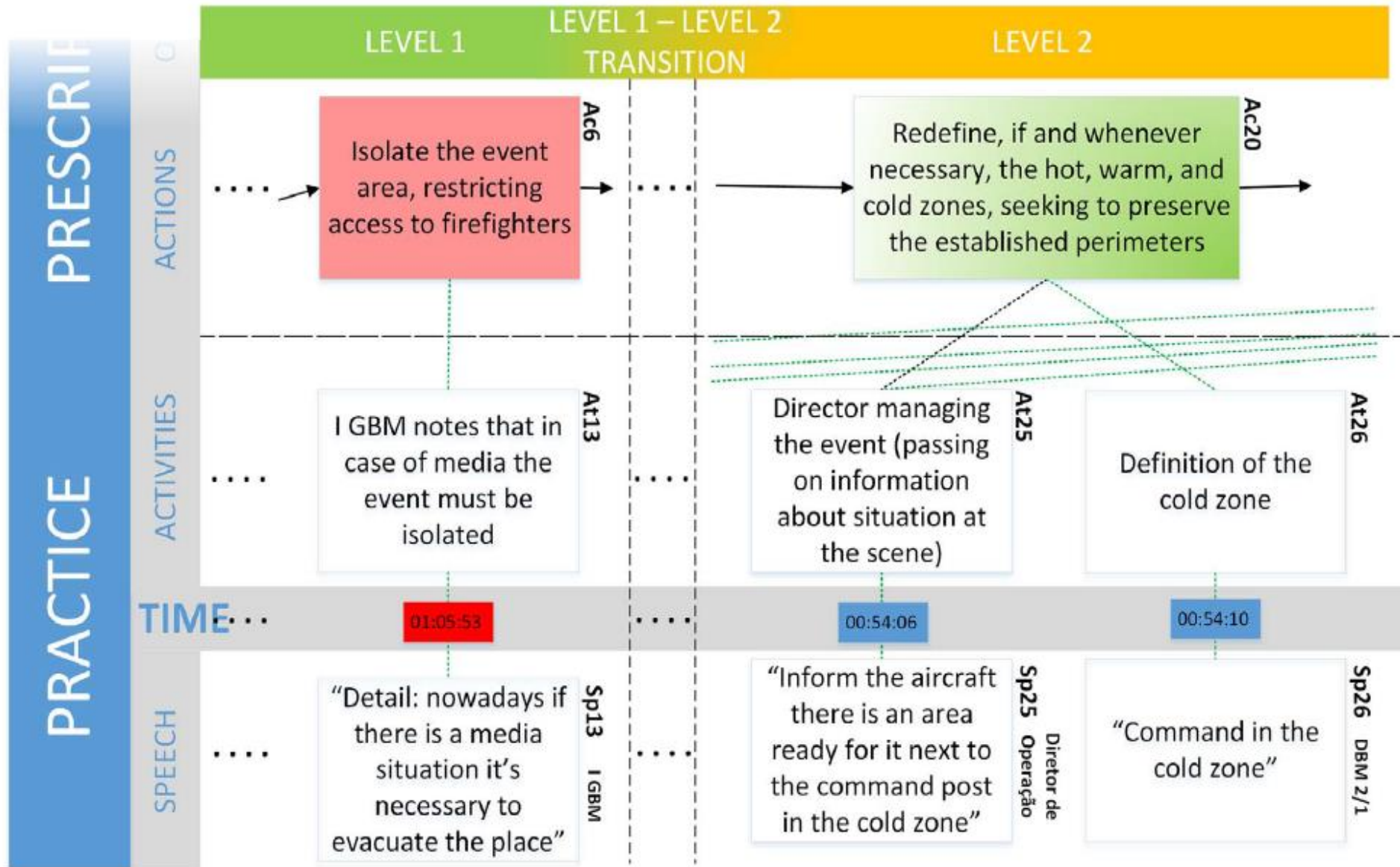


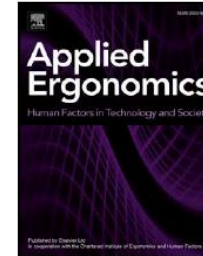
Fig. 7. Organizing the event response site.



Contents lists available at [ScienceDirect](#)

Applied Ergonomics

journal homepage: www.elsevier.com/locate/apergo



Reflections on work as done (WAD) and work as imagined (WAI) in an emergency response organization: A study on firefighters training exercises



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Next steps

- To review SOP's
- Detailed analysis on sensemaking process
- Review and improve simulation exercises w/ Firefighter Academy
- Set up collaboration among BRICS countries,
-

ERIC
STI FRAMEWORK PROGRAMME

News

ABOUT BRICS STI NEWS PROJECTS FUNDING OPPORTUNITIES

Meetings
News

2nd BRICS Call 2017 application submission deadline has been extended to 27th December 2017!

27 November 2017

2nd BRICS Call 2017 application submission deadline has been extended to 27th December 2017!

Please consult with national contact points on extension of deadlines for national application submission.

I-2. Aim of the Joint Call and Thematic areas Collaborative multilateral basic, applied and innovation research projects in the following thematic areas can be submitted in response to the call:

Prevention and monitoring of natural disasters

Human factors such as globalization, population growth, poverty, urbanization and changes in land use are aggravating the negative consequences of natural hazards. Earthquakes and more frequent and intense extreme weather and climate events are also increasing the risks faced by populations living in vulnerable areas. The losses are increasing in BRICS countries.



PPGI PROGRAMA
DE PÓS-GRADUAÇÃO
EM INFORMÁTICA



**Большое вам спасибо
за терпение!
Thank you so much for
your patience!**



Confederations Cup / WYD.2013

Gomes Filho et al.

C2 Center dealing with the unexpected

C2 Center dealing with the unexpected: resilience and brittleness during FIFA Confederation Cup

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ABSTRACT

Forecast and plan response to incidents are fundamental to create a Command and Control Center (C2 Center). However, some incidents are considered chaotic and are completely understood only after happening. These unforeseen incidents pose challenges to plans of such centers and if not properly managed, may result in failures. This article describes how the Integrated C2 Center of Rio de Janeiro City (CICC-RJ) responds to violent, unexpected and improbable events, especially related to protests that took place during the 2013 FIFA Confederations Cup. It aims to describe from the resilience engineering point of view how the CICC-RJ function to cope with incidents, where the structure has proved to be resilient, where it holds brittleness, and to suggest possible actions to help the center to become more resilient to upcoming events.

Keywords

C2 Center, protests, unexpected, Rio de Janeiro, Resilience

França et al.

The Pope's Visit to Brazil for the WYD

A Critical Insight of the Pope's Visit to Brazil for the World Youth Day: Resilience or Fragility?

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ABSTRACT

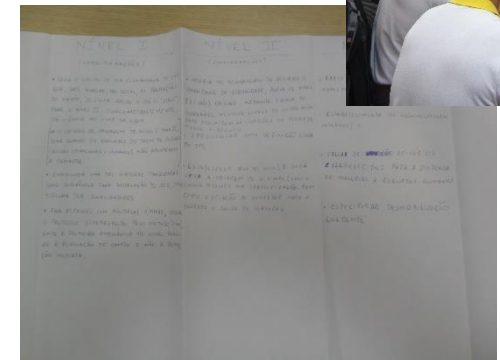
This work proposes a model to evaluate systems regarding their resilience in handling unexpected disturbances. To exemplify the use of the proposed model, we chose to analyze the World Youth Day (WYD), an important event on the global scenario that happened this year in Rio de Janeiro, a city which will host big events in the next few years, like the World Cup and the Olympic Games. From this event, we chose two disturbances that stressed the system and had the possibility to cause a lot of problems to the event and the city, like the rains in Guaratiba and the arrival of the Pope's committee. After analyzing how the overall WYD organization deal with these disturbances we conclude that, besides the success of the event, the organization showed much more signs of brittleness than resilience.

Keywords

Resilience Engineering, Resilience Analysis, World Youth Day

June.2015 Simulation

- Student Preparatory Exposure
 - Workshop participation
 - 2 moments for discussion of improvements in the main SOP
 - Study the exercise's characteristics
 - Discuss the adjustments with the facilitator
 - Change the room layout
 - Use vests for easier identification



June.2015 Simulation

- Exercise preparation
 - Assemble the resources for data collection
 - 20 researchers
 - 12 cameras
 - 15 voice recorders
 - Prepare the location beforehand (previous day)
 - Position cameras
 - Position radios
 - Observation Instructions

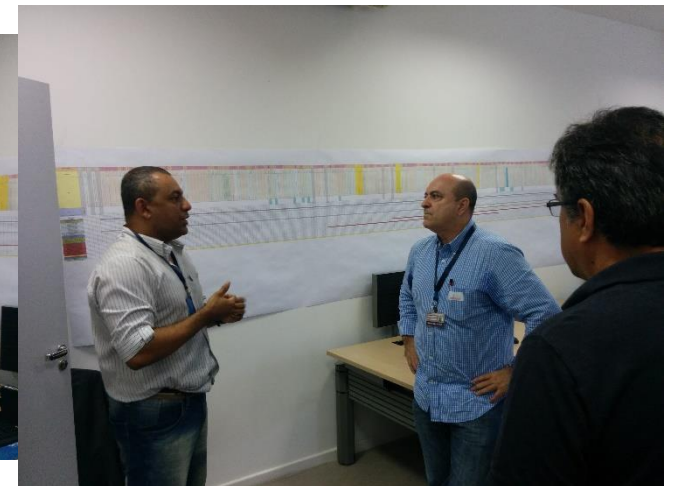
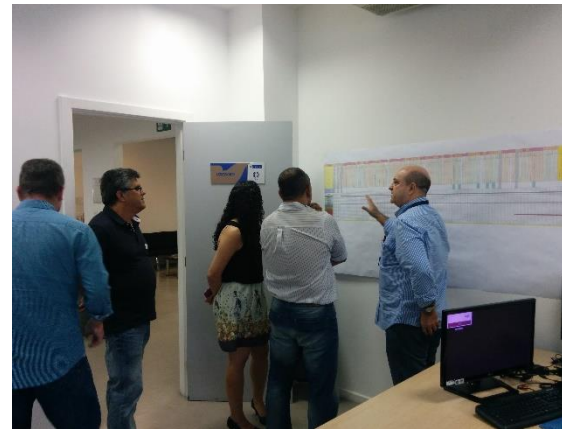
June.2015 Simulation

- The simulated exercise
 - 35 participants
 - 11 groups
 - 5 teams in the field
 - 6 command and control teams (internal to the Fire Department units)
 - Briefing
 - Undertaken in the simulation environment by the facilitator with participants
 - Exercise
 - Approximately 1h30min of activity
 - Debriefing
 - Didn't happen

June.2015 Simulation

- Analysis of the data
 - Transcription of the audio recordings
 - Analysis of the video recordings
 - Analysis of the observation reports
- Validation by/with the facilitator & participants
 - Main insights

Time	Activity	Participant	Facilitator	Observer	Notes
10:00	Simulation Start	Participant 1	Facilitator 1	Observer 1	Initial setup and instructions.
10:05	Task 1	Participant 2	Facilitator 2	Observer 2	Participant 2 starts task 1.
10:10	Task 2	Participant 3	Facilitator 3	Observer 3	Participant 3 starts task 2.
10:15	Task 3	Participant 4	Facilitator 4	Observer 4	Participant 4 starts task 3.
10:20	Task 4	Participant 5	Facilitator 5	Observer 5	Participant 5 starts task 4.
10:25	Task 5	Participant 6	Facilitator 6	Observer 6	Participant 6 starts task 5.
10:30	Task 6	Participant 7	Facilitator 7	Observer 7	Participant 7 starts task 6.
10:35	Task 7	Participant 8	Facilitator 8	Observer 8	Participant 8 starts task 7.
10:40	Task 8	Participant 9	Facilitator 9	Observer 9	Participant 9 starts task 8.
10:45	Task 9	Participant 10	Facilitator 10	Observer 10	Participant 10 starts task 9.
10:50	Task 10	Participant 11	Facilitator 11	Observer 11	Participant 11 starts task 10.
10:55	Task 11	Participant 12	Facilitator 12	Observer 12	Participant 12 starts task 11.
11:00	Task 12	Participant 13	Facilitator 13	Observer 13	Participant 13 starts task 12.
11:05	Task 13	Participant 14	Facilitator 14	Observer 14	Participant 14 starts task 13.
11:10	Task 14	Participant 15	Facilitator 15	Observer 15	Participant 15 starts task 14.
11:15	Task 15	Participant 16	Facilitator 16	Observer 16	Participant 16 starts task 15.
11:20	Task 16	Participant 17	Facilitator 17	Observer 17	Participant 17 starts task 16.
11:25	Task 17	Participant 18	Facilitator 18	Observer 18	Participant 18 starts task 17.
11:30	Task 18	Participant 19	Facilitator 19	Observer 19	Participant 19 starts task 18.
11:35	Task 19	Participant 20	Facilitator 20	Observer 20	Participant 20 starts task 19.
11:40	Task 20	Participant 21	Facilitator 21	Observer 21	Participant 21 starts task 20.
11:45	Task 21	Participant 22	Facilitator 22	Observer 22	Participant 22 starts task 21.
11:50	Task 22	Participant 23	Facilitator 23	Observer 23	Participant 23 starts task 22.
11:55	Task 23	Participant 24	Facilitator 24	Observer 24	Participant 24 starts task 23.
12:00	Simulation End	Participant 25	Facilitator 25	Observer 25	Final debrief and feedback.



June.2015 Simulation

- ABERGO 2016
- ISCRAM 2016

Firefighting emergency response exercise – an analysis of standardization and resilience

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ANÁLISE DA COMPLEXIDADE EM EXERCÍCIOS DE RESPOSTA A EMERGÊNCIA – UM ESTUDO DE CASO COM BOMBEIROS

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Resumo

O presente estudo apresenta uma análise das características de complexidade identificadas em um exercício de resposta a emergência realizado durante o programa de capacitação para capitães do Corpo de Bombeiros do estado do Rio de Janeiro, Brasil. A partir do registro audiovisual do exercício realizado por 35 jovens oficiais foi possível aplicar técnicas de análise cognitiva da tarefa para identificar um conjunto de características de complexidade ancorada nos preceitos da Engenharia de Resiliência. De modo geral, as quatro características investigadas foram parcialmente verificadas. As características de grande número de elementos em interação, diversidade de elementos e variabilidade inesperada foram mais evidenciadas do que a característica de resiliência. Sendo a resiliência aspecto fundamental para serviços como o realizado pelos Bombeiros, no qual a imprevisibilidade e necessidade de constante adaptação e reorganização são necessárias, identifica-se uma oportunidade de melhoria relacionada ao exercício simulado. Esta oportunidade está relacionada principalmente ao incremento de elementos e situações que levem a um maior desenvolvimento da resiliência. Contudo, a identificação de aspectos relacionados às quatro características propostas permite evidenciar a relação do exercício com a dia-a-dia dos Bombeiros, auxiliando na estruturação de propostas de simulação mais próximas ao trabalho real vivenciado pelos mesmos.

Palavras-chave: resposta a emergência, bombeiros, características de complexidade, resiliência.

SIGNIFICANCE AND RELEVANCE OF TOPIC

Empirical studies involving complex systems are challenging, especially in sectors dealing with emergency response. In these systems, knowing the real work is fundamental to support better artefact, tool and technology design. Data analysis matching the reality of systems and agents to their imagined conditions is the best way to refute or corroborate theories, models and concepts arising from academia. In this study, the insertion of the real world context of firefighter activities as a research environment, albeit in a simulation, brings to light issues suggested by the Resilience Engineering approach, and elucidates fundamental aspects of activities in critical and tough situations. Additionally, awareness of the dynamic of the differences between work as done and work as imagined can be of direct assistance in establishing preparedness for emergency response.

