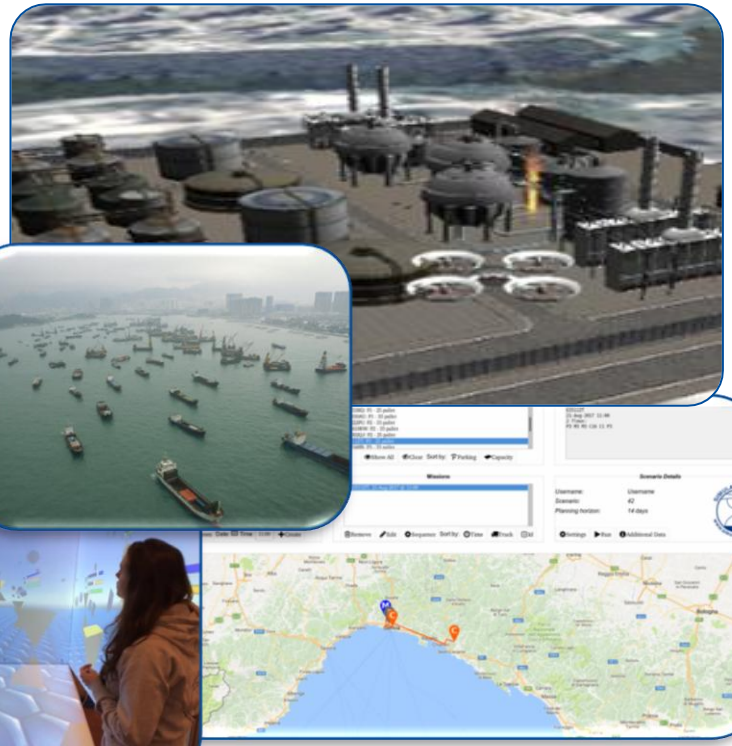
Simulation Team

ALACRES2

Servizio Avanzato di Laboratorio per Crisi ed Emergenze, in porto nello Spazio di cooperazione dell'alto tirreno, basato su Simulazione

Advanced Laboratory for Crisis and Emergencies in Ports and marine domain developed by Simulation within a common collaborative Space

Agostino G. Bruzzone
Simulation Team, DIME University of Genoa
Email agostino@itim.unige.it



Unclassified – For Public Release - Unlimited

Simulation Team

ALACRES2

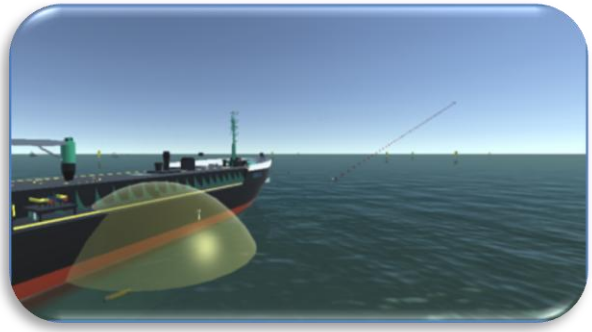
Advanced Laboratory for Crisis and Emergencies in Ports and marine domain developed by Simulation within a common collaborative Space

The objective of ALACRES2 is to activate a permanent laboratory able to identify, test and validate integrated emergency management procedures in the event of accidents, crises or significant accidents occurring during loading and unloading in port

ALACRES2 allows you to identify univocal management and behavioral protocols to assist the improvement of workers' skills in the emergencies of an extremely critical phase of the supply chain.
The activity therefore has the task of investigating the behavior of the different operational figures of emergency management in the case of accidents going to test new behavioral protocols, new operating standards, new procedures for monitoring and control of the emergency, new technologies for the infrastructure and on-board systems.

Simulation Team

ALACRES2 Approach



the ALACRES2 laboratory investigates and analyzes the behavioral procedures & protocols for:

- Vertices of the chain of command and / or operating centers of management, or those who are deputies to manage an emergency condition lasting over time (widespread and prolonged fire, spill in uncontrolled water, evolving toxic cloud, etc.)
- Operational subjects in charge of the first intervention activities aimed at curbing the emergency and / or reducing the causes that generated the indicator (fire brigade, emergency workers, etc.)

ALACRES2 is based on simulation techniques of operational and decisional behaviors aimed at training the different subjects to perform their respective tasks in conditions of mental and physical stress and work overload, in order to evaluate incorrect processes, incorrect methods of sending and / or information management, decisions that do not comply with external conditions, etc.
The simulation makes it possible to reproduce the evolution of the crisis and the impact on structures, systems, people and goods, considering the physical aspects and the domino effect in its dynamism.
ALACRES2 is able to evaluate new solutions to reduce vulnerability, mitigate damage and prevent emergencies. The MS2G paradigm will be adopted (Modeling, interoperable Simulation and Serious Games) to be able to combine different models and guarantee a high level of fidelity and at the same time the simplicity of use, the intuitiveness and the immersive capabilities

Simulation Team

Attività ALACRES2

T1: State of the art on the major disasters and definition of ALACRES2 simulator specifications

T1.1 Survey on the Main Disasters and Crises in the Marine and Port Area,

T1.2 Critical Analysis of Crises, Incidents, Impacts and Modalities of Intervention,

T1.3 Definition of Simulator Requirements, Scenarios and Specifications

T2: Creation of the Emergencies Laboratory and the ALACRES2 Simulator

T2.1 Development of Intelligent Systems for Crisis Management

T2.2 Development of Simulation Models and Emergencies Laboratory Infrastructures

T2.3 Virtual Laboratory Setup based on the ALACRES2 Simulator

T3: New Guidelines for Emergency Management in the analyzed scenarios

T3.1 Definition of the Experimentation to develop Guidelines for Managing Crises

T3.2 Management of Communications and Information in an Emergency Situation,

T3.3 Simulation and Analysis Functions Objective for Evaluation of the Procedures

Simulation Team

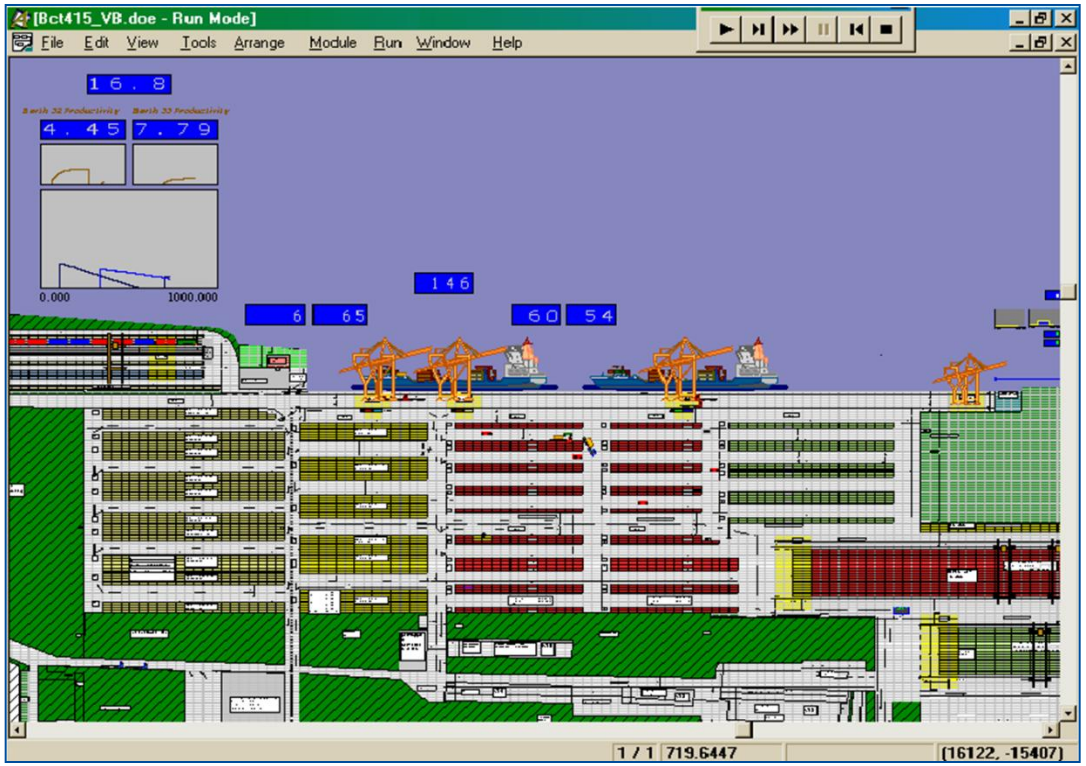
M&S Solutions

Modeling and Simulation allows to reproduce real world in Interactive Virtual Frameworks. Simulation is a Strategic Science to investigate complex and new systems by using models able to conduct experiments, tests and exercises useful to understand and experience them.

M&S supports multiple applications including among the others Design, Thanks to its capability to reproduce complex phenomena, Simulation is currently an indispensable problem solving methodology for many real world problems involving complexity.

Ann innovative approach in M&S is the Modelling, interoperable Simulation & Serious Games (MS2G) paradigm that combines M&S fidelity, Simulation interoperability plus intuitive& engaging characteristics of Serious Games (SG).

In MS2G, M&S and SG are combined by integrating different Models to create virtual Worlds easily deployable on multiple distributed Solutions



Simulation Team

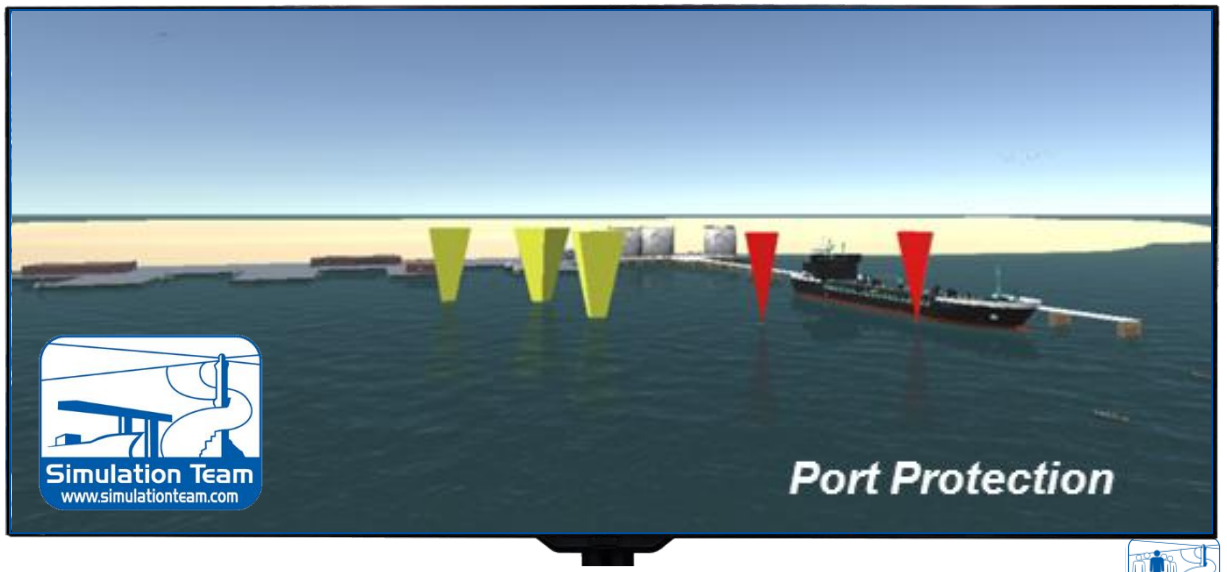
AI & IA Solutions

Artificial Intelligence (AI) are techniques that are designed to reproduce intelligent process; in fact AI is a very challenging sector that still requires a lot of activities in R&D. M&S and AI are strongly connected because Simulation needs to incorporate intelligence in order to direct entities, virtual humans, virtual organizations, virtual planning. From another perspective AI requires to use simulation results to evaluate alternatives and feed its algorithms by forecasts.

In Simulation Intelligent Agent (IA) represent a crucial element to couple complex scenarios with many entities interacting in complex way. The IAs typically represent people, groups or units, and reproduce corresponding desired behaviors. IAs allow an object to respond to changes of the situation and based on their perception of the scenario.

Use of agent-driven simulations based on human behavioral models (HBM) are crucial to recreate very complex and extended scenarios including population as well as other non-conventional agents.

Simulation Team Genoa has Very Large Experience in this field.

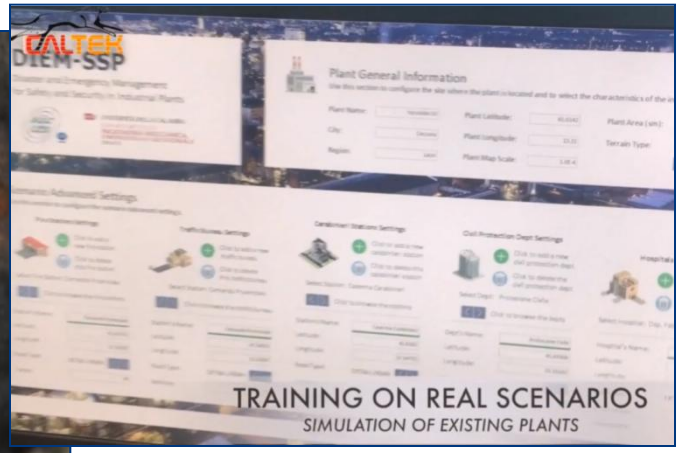


DIEM-SSP

Augmented Reality TErrain interoperable Module

DIEM-SSP was one of the inspiring elements of ALACRES2.

DIEM-SSP is a project devoted to create a common framework that combines Virtual and Constructive Simulation to support Crisis Management in Industrial Plants. The Models allows to be used as training system both for internal personnel of the Plants as well as for Crisis Managers and *First Responders*. This Simulator support also development of SOP and support Engineering.



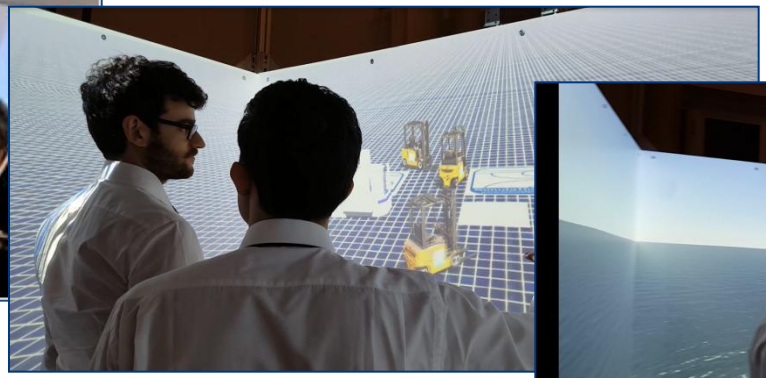
Simulation Team

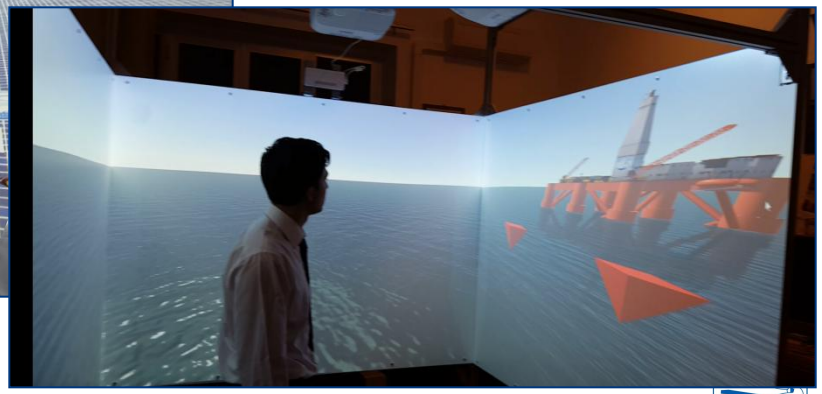
SPIDER

Simulation Practical Immersive Dynamic Environment for Reengineering

The SPIDER (Simulation Practical Immersive Dynamic Environment for Reengineering) is an innovative Interactive and Interoperable CAVE (Cave Automatic Virtual Environment) developed by Simulation Team. The basic configuration is compact (just 2m x 2m x 2.6m) and could be embedded within a standard Container and integrated in any interoperable simulator.

The SPIDER is interactive through touch screen technologies.





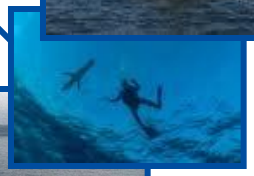
The SPIDER is fully Immersive including sound and motion.

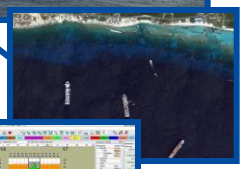
Simulation Team

The Real World: Multi Dimension and Multi Layer Resolution

An Example on a Marine Scenario

- A Real World on ***Multi Dimensions***:
  - Surface
  - Underwater
  - Air
  - Space
  - Cyber
  - Ground

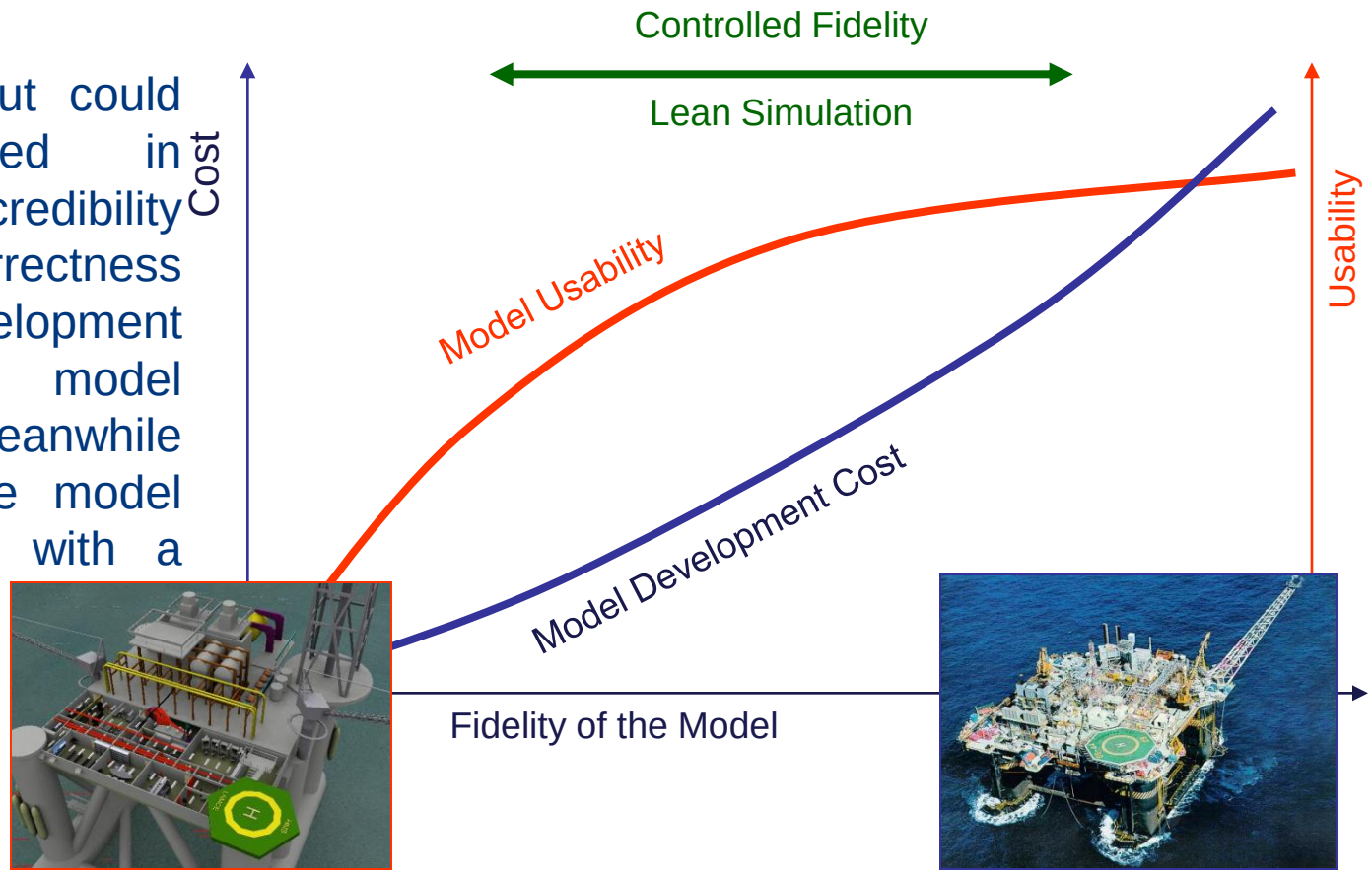


- A *Multi Layers & Resolutions Frame*
  - Fleets and Parties
  - Ships and Commercial Traffic
  - Crew & People Acceding Ports/Vessels
  - Services & Infrastructures



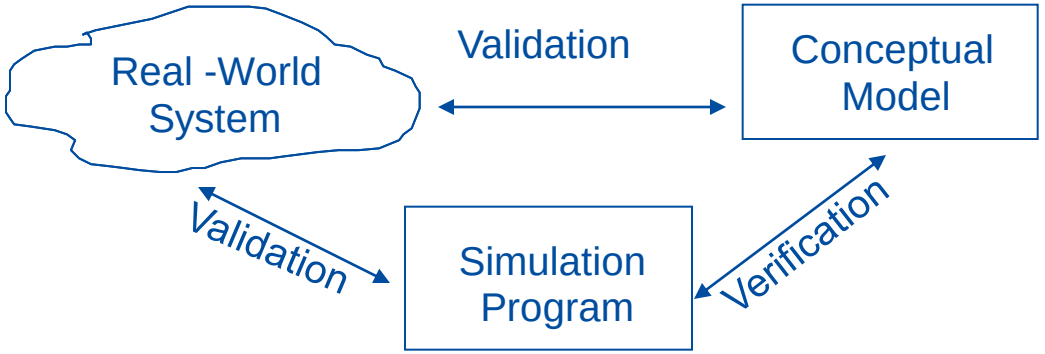

Usability vs. Fidelity in M&S

- A model Output could be considered in relation to a credibility level. If correctness grows, development cost of the model grows; meanwhile usability of the model increases, but with a non-linear, and usually at decreasing, rate.



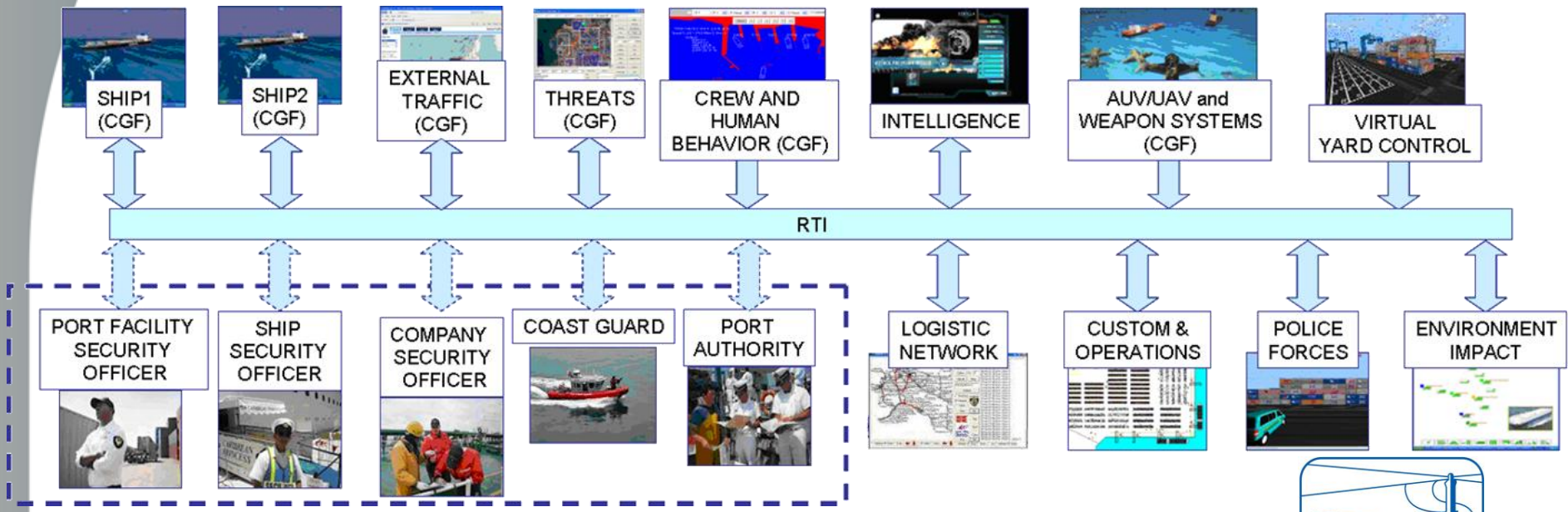
Validation and Verification as Critical Issues

- **Validation is the process of determining whether the conceptual model is an accurate representation of the actual system being analyzed. Validation deals with building the right model.**
- **Verification is the process of determining whether a simulation computer program works as intended (i.e., debugging the computer program). Verification deals with building the model right.**



Example of Federation for Port Protection: ST_VM

Simulation Team Virtual Marine is an Federation based on HLA Standards (High Level Architecture)



Extract from Bruzzone A.G. , Tremori A., Bocca E (2010) "Security & Safety Training and Assessment in Ports based on Interoperable Simulation", I3M2010, Fes

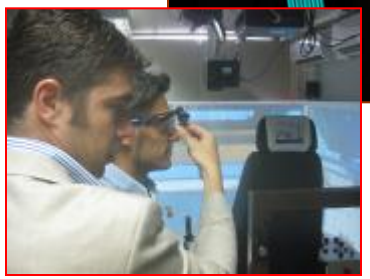
Simulation Team

Human Performances… a Step Forward during Training

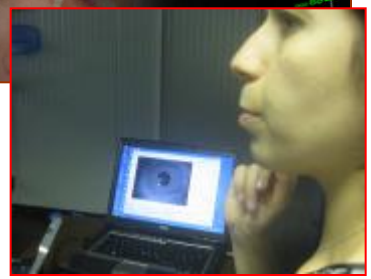
Virtual Solution integrated with Biomedical Devices to measure the Human Performances within HLA federation allows to Measure Fatigue, Stress for correlating Human Factors during Operations & Training in order to improve Efficiency and Safety

VR & AR

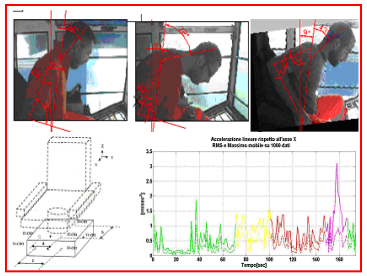
Interoperable Biometrics



ST_VP Solution



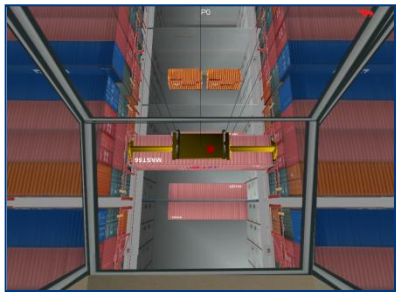
ST_VM

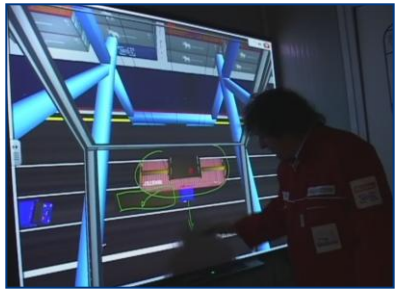


ST_PT

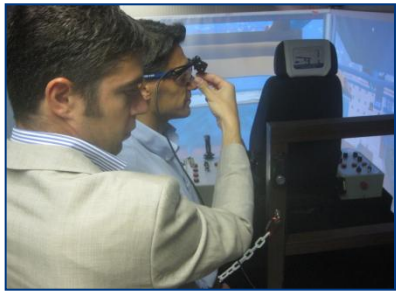
Simulation Team

ST_VM Simulators





Shelter & Facilities



ST_PT Crane Sim

ST_PT Truck Sim

This new generation of simulator is mobile, real-time, scalable and interoperable and compliant with state of art technology and standards

Simulation Team

Atout in Virtual Port Simulation

Simulation Team

Modularity & Flexibility

Simulation Team

Mobile Training Concept

Simulation have great potential in many applicative areas therefore currently there is a growing need for developing Mobile Training Simulation Solutions

The use of mobile training requires to define properly procedures for using them effectively in order to obtain benefits in different contexts.

Università di Genova

Simulation Team

Lean Simulation

Lean Simulation deal with development of specific models starting from "model templates" customized on specific application fields which could be tuned quickly by small team of experts.

These teams are expected to use Design of Experiments in pragmatic way to face criticalities and to complete quickly validation, verification and preliminary analysis

By this approach fidelity level and confidence band of simulators are relaxed in order to speed-up developments, tailoring and analysis

Simulation Team

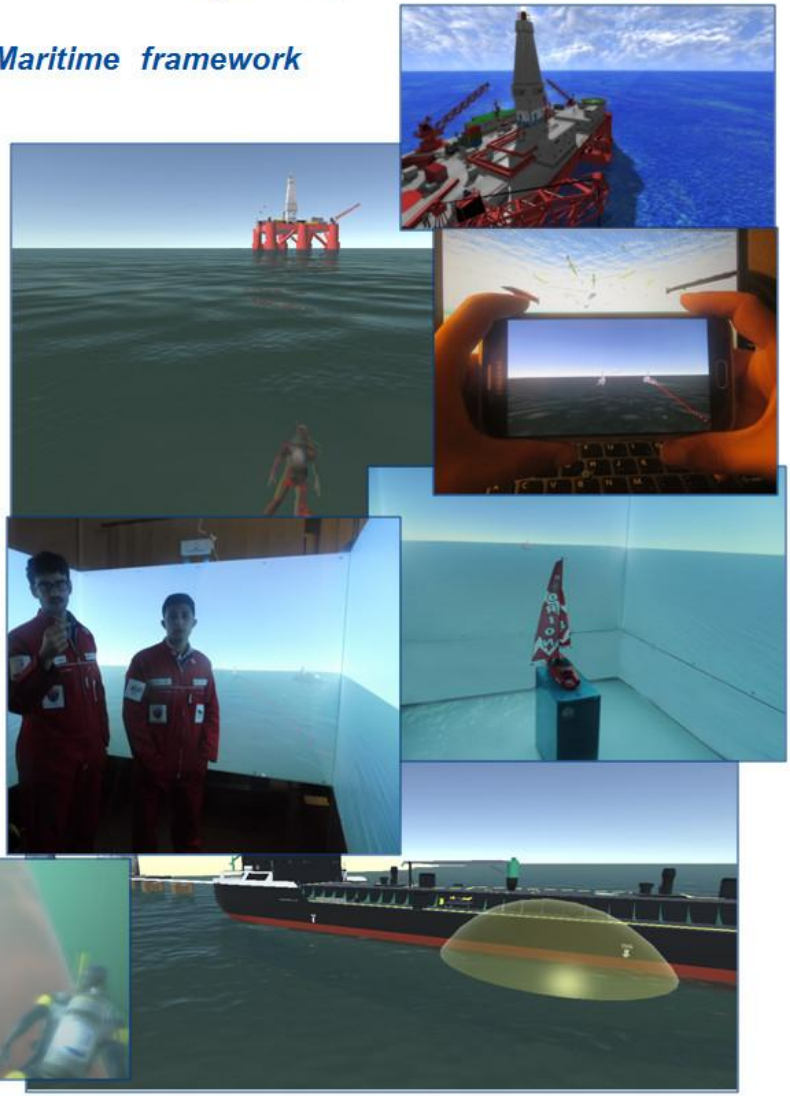
CRIPEM

CRitical Infrastructure Protection in Extended Maritime framework

Oil Rig Protection (ORP) is a virtual MS2G (Model, interoperable simulator & Serious Game) reproducing operations devoted to protect critical infrastructure at sea from multi domain threats.

The simulator reproduces use of traditional assets as well as innovative autonomous systems in reference to different potential targets including ports, terminals and Oil Rigs.

The Simulator could be used for training, education as well as for capability assessment, vulnerability reduction and procedure definition respect a wide spectrum of threats



Simulation Team

ST Train

Simulation Team Solutions for Training

Simulation Team develops many different kind of training simulation from Ship Bridge for Defense & Commercial Applications to Port Cranes, Drones and Vehicles. ST_VM (Simulation Team Virtual Marine) is a complete suite devoted to Simulate ships, boats, gantry cranes, trucks, straddle carriers, contstackers, Fixed and Rotary wing UAV, etc. ST_VM supports training Dual Use and addresses Safety and Security purposes. ST_VM is an interoperable distributed real time simulation including vibrations, motions, 3D Stereo Sounds, etc. All Simulation Team solutions are interoperable through HLA providing the possibility to support collective training for cooperative operations in complex scenarios. Simulation Team Solutions are scalable from Workstations up to Full Scope Simulator wrapped in 40' Containers able to be moved around the world and become operative within four hours. All solution are modular and provide support to integration with Biomedical Device for Monitoring the stress and fatigue level of the trainees.

DIME
Università di Genova

Simulation Team

Virtual Security Assessment and Training

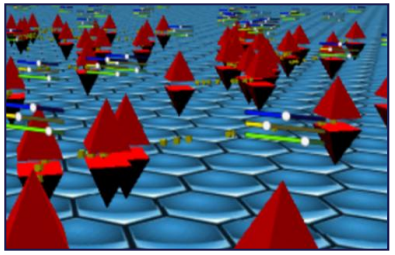
VISAT (Virtual Security Assesment and Training) allows to Simulate Security Issues in Complex Framework such as that one related to Port Environments.

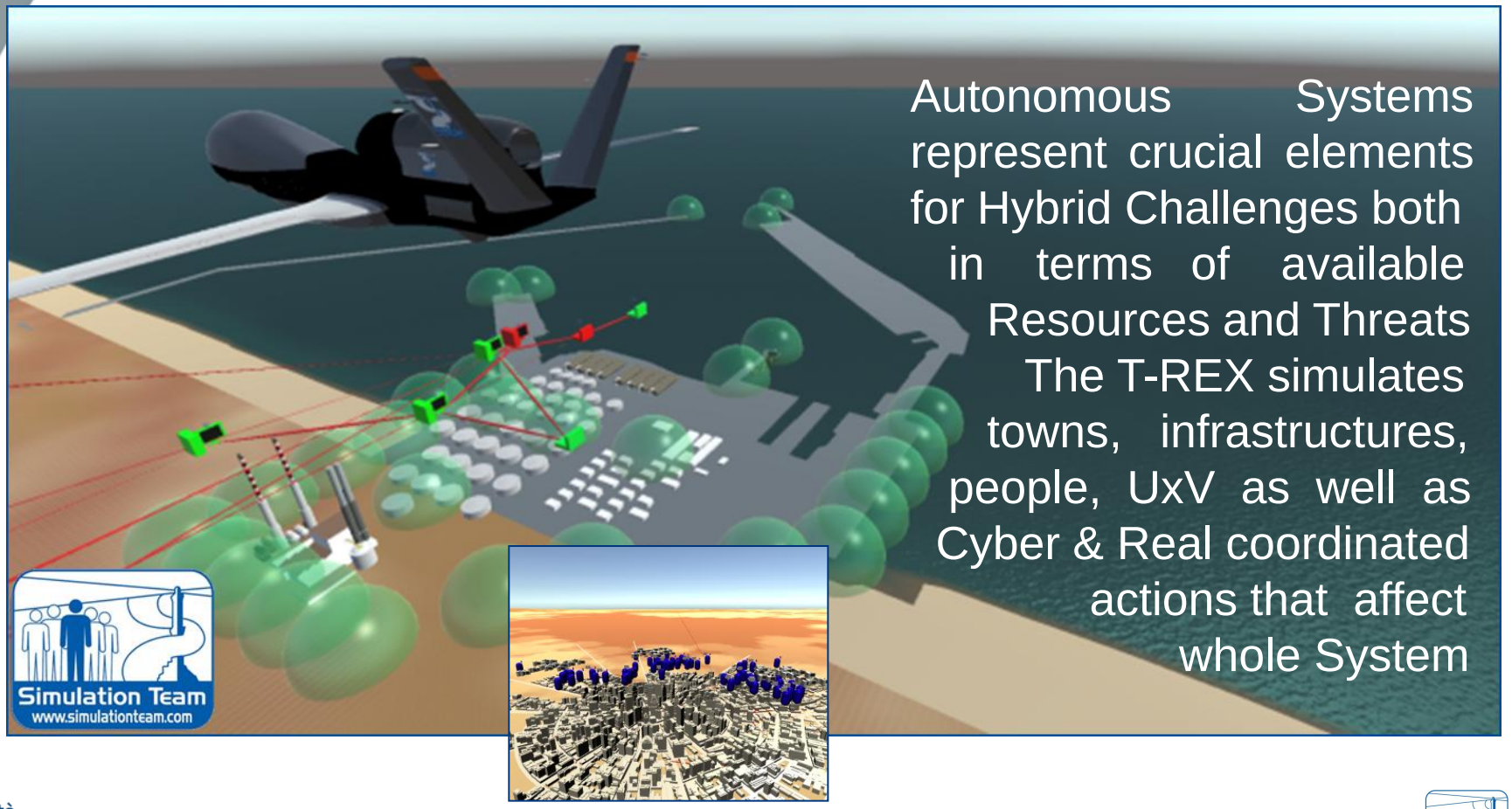
VISAT includes Constructive Sim of organizations and layouts as well as Synthetic Environment for Virtual Sim supporting Collective Training among different Actors (i.e. Port Authority, Coast Guard, Custom Resources, Terminal Operators, Public Urban Authorities) within different Scenarios

Università di Genova

Simulation Team

Hybrid Challenges & Innovative Systems





Autonomous Systems represent crucial elements for Hybrid Challenges both in terms of available Resources and Threats The T-REX simulates towns, infrastructures, people, UxV as well as Cyber & Real coordinated actions that affect whole System

Simulation Team

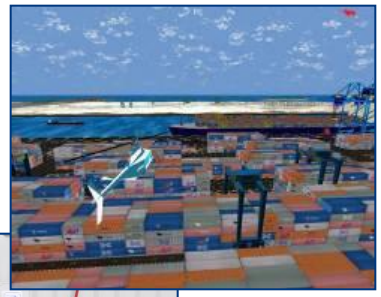
Conclusions

- This quick overview makes the potential clear of the MS2G approach to support security within the Extended Maritime Framework and to create the Virtual Laboratory of ALACRES2

- These models effectively reproduce complex systems and are virtual prototypes capable of interaction with users as well as with real hardware to test and evaluate alternative solutions to support Logistics, Operations, Supply Chain
- MS2G paradigm proposed confirm the capability to develop intuitive and interoperable Simulation Solution in quick time to address major challenges and to support different issues from Capability Assessment to Education & Training
- The proposed Models and Simulators could be easily tailored to be adapted to different scenarios and to be used for different users with specific problems to be solved in reorganizing Logistics Networks or training Managers and Operators
- Currently Simulation Team is active in developing new solutions tailored based on final user needs and in supporting development of Training and Educations Solutions as well as R&D Projects

Simulation Team

References



Simulation Team

DIME Genoa University

Agostino G. BRUZZONE

agostino@itim.unige.it

www.itim.unige.it/projects

DIME