



Simulation Team



Learning Decision Making Processes at Strategic Level based on VR & AR



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Overview



To evaluate the potential of using innovative immersive techniques to support decision making over complex problems.

Check technological solutions based on VR and AR to support strategic decision making

To validate the concept to use Virtual Reality and Augmented Reality as enablers to improve understandings, situation awareness, variable correlations as well as impacts estimation

Use of MS2G (Modelling, interoperable Simulation and Serious Games) paradigm to address these issues

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Goals

This research addresses
**Strategic Decision Making with
VR & AR in Education in terms of:**

- To investigate the potential of immersive technologies for supporting Education and Training (E&T) with special attention to Strategic Level
- To identify and evaluate current Shortfalls and Opportunities in Education of Decision Makers
- To outline different solutions adopting Virtual Reality (VR) and Augmented Reality (AR) for Strategic Education
- To identify possible Simulators and Serious Games already available to conduct experimentation in this sense
- Examples of already conducted experimentations





Enhancing for Decision Making Process by Education



Decision Making Processes require today to face criticalities:

- Decisions need to more Quick
- Very Dynamic Scenarios
- Very Large Scenarios
- Large International Coalitions
- Multi Domain & Multi Layers
- Data Dominance is more crucial
- Many influent Stakeholders
- Consensus vs Leadership
- Burocracy vs. Organization
- Lack of Trust in Organizations
- Overstressed Technologies

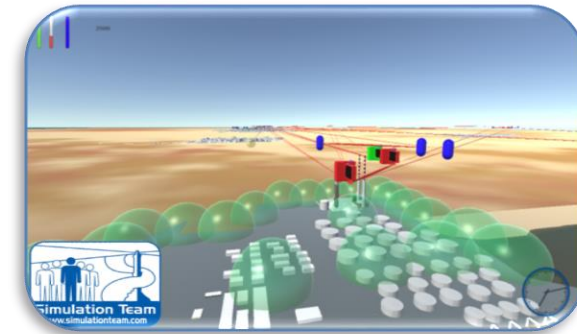
Education in Strategic Decision Making could benefit from:

- Simulation based E&T
- Mobile Training
- IA/AI as Sparring Partners
- Virtual Reality to *live it*
- Augmented Reality to *see it*
- New Models & Paradigms
- Comprehensive Approach
- Immersive Environments
- Collective E&T
- Data Farming based on CAX
- Blended Education





M&S, SG, VR & AR



M&S: Modeling & Simulation use the computers to recreate real systems to conduct experiments and exercise in virtual worlds

SG: Serious Games are devoted to E&T instead than entertainment

VR: Virtual Reality immerses the user into a Virtual Framework in a flexible way by using multiple platforms & I/O devices (e.g. Smart phones, CAVE, SPIDER™, PC, Laptop, HDM , Hololens™, Data Gloves, Motion Platforms, Motion Capture, Force Feedback, etc.)

AR: Augmented Reality is a live direct or indirect view of a physical real world whose elements are augmented by additional information from computers, it is possible to add data from Dbase, Sensors, Video, GPS, etc.

E&T Education & Training

GPS Ground Positioning System

CAVE Cave Automatic Virtual Environment

HDM

SPIDER

Head Mounted Display

Simulation Practical Immersive Dynamic Environment for Reengineering

I/O

Input Output

PC Personal Computer

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Example of Overall Architecture

Simulation

Man on the Loop

VR & AR

Real Situation

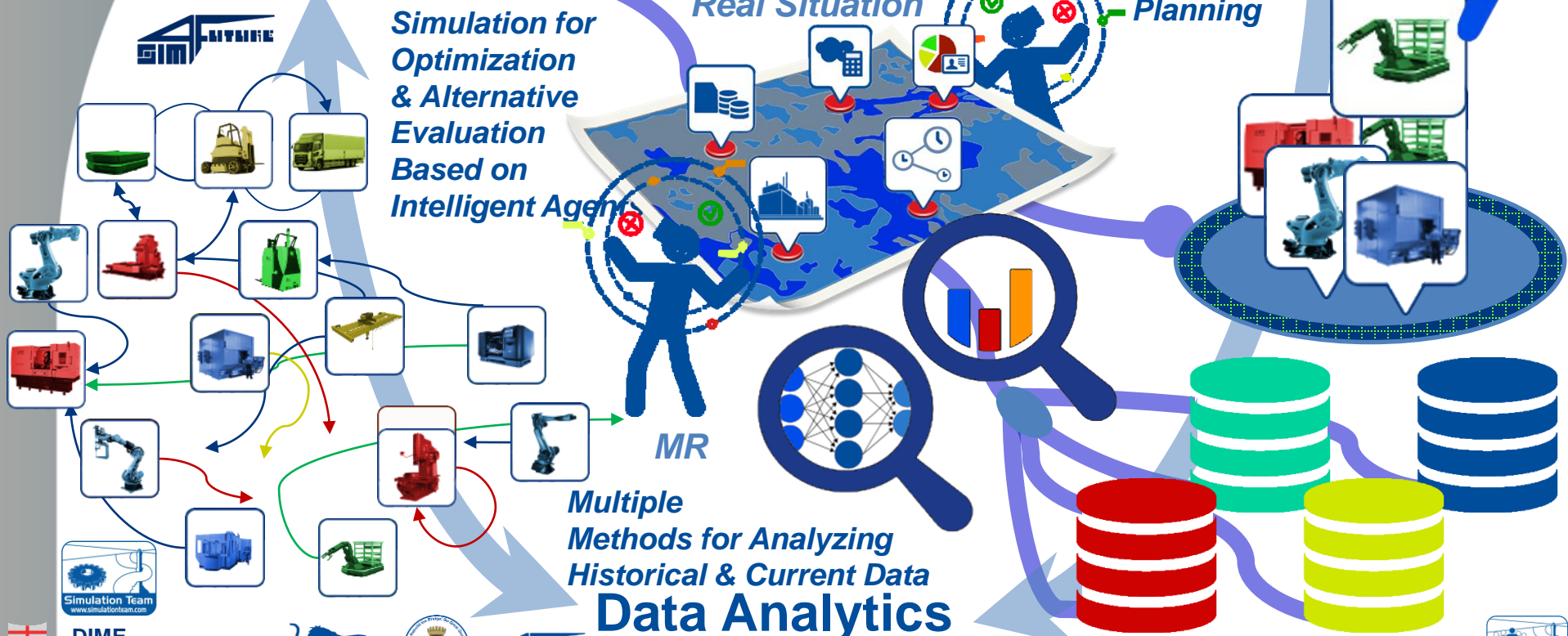
Manual & Automated Planning

Simulation for Optimization & Alternative Evaluation Based on Intelligent Agents

MR

Multiple Methods for Analyzing Historical & Current Data

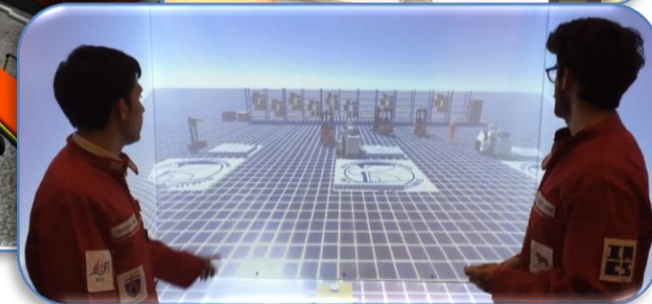
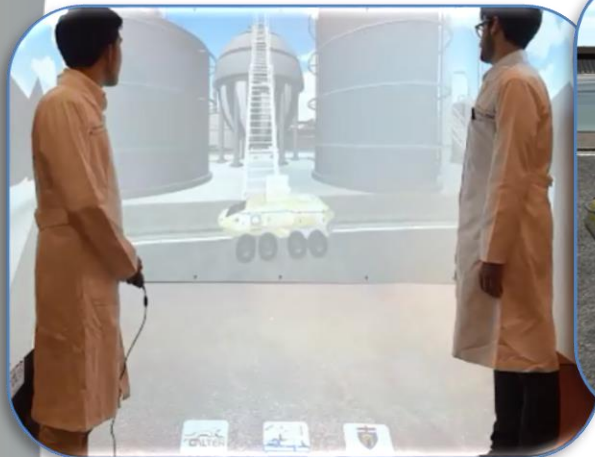
Data Analytics





MS2G Paradigm as new Enabler

The innovative concept of MS2G (Modeling, interoperable Simulation and Serious Games) allows to develop interoperable scalable and reusable simulators with benefits of new Immersive Solutions. MS2G is very flexible and enable use from different platforms: regular laptops, computers, CAVE (Computer Automatic Virtual Environment) large enough to immerse 4-5 people in the Virtual World, HDM, HoloLens as well as Smartphones and Tablets





Interoperable Virtual Simulators & Models



The Smart Simulators represent the crucial element to support advance and revolution in Engineering, Management and Training. The Virtual Simulators are aids for Operative Resources, Technical Staff & Decision Makers. The Interoperability of simulators could be based on most advanced standards and paradigms (i.e. HLA High Level Architecture, MS2G, Modeling, Interoperable Simulation & Serious Games). These Solutions enable stand-alone and Federated Simulation of Operations, Activities and Processes.



Simulation Team have very long experience in Project with major Industries and leading International Agencies and Institutions

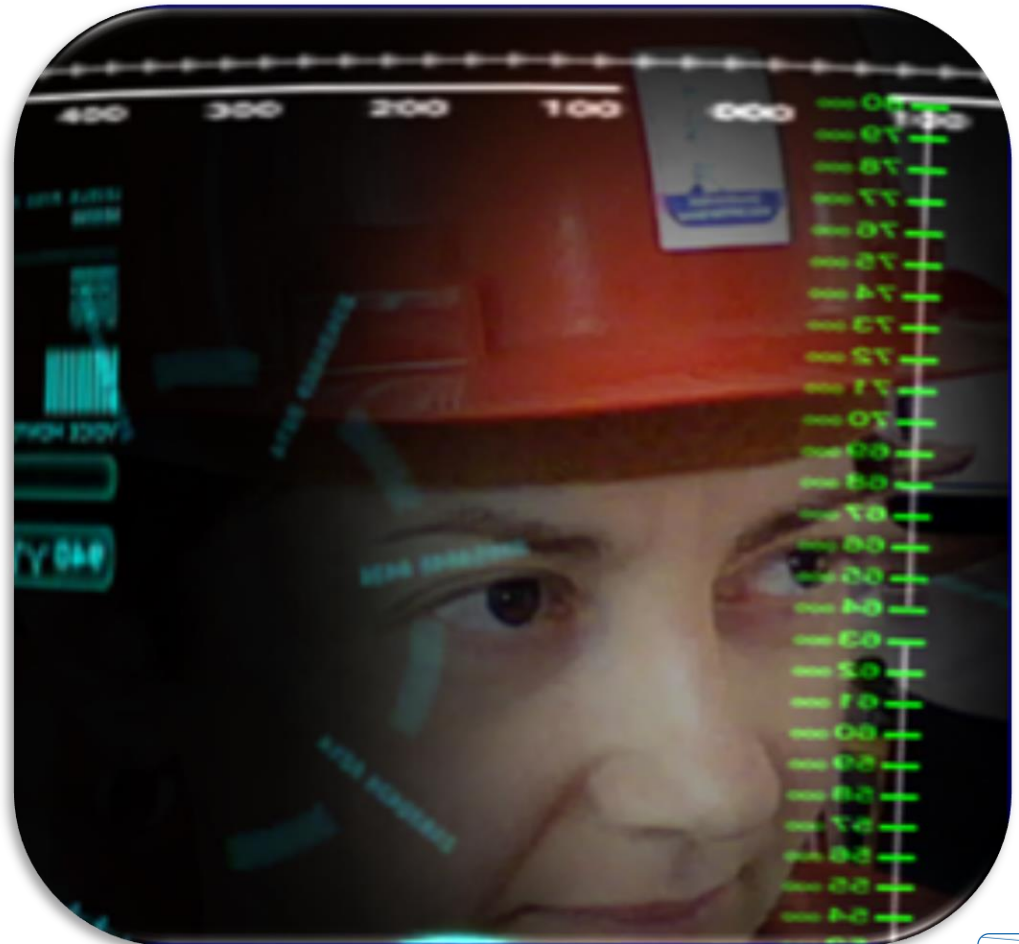




Future Uses and Innovative Interface

AR/VR architectures are able to be integrated with future technologies for supporting new solutions.

- Collaborative Working
- Monitoring & Tracking
- Remote Supervision
- After Action Review
- Mobile Education & Training
- Scenario Awareness
- Crowdsourcing
- Table Top Exercises
- Availability Improvements

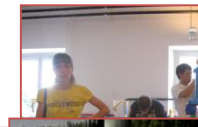
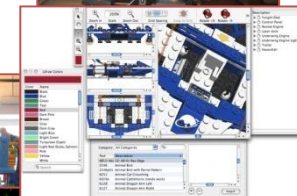




Opportunities from Serious Games in Engaging Education...

There are multiple opportunities provided by Serious Games:

- New Virtual Environments engaging User
- Introduction of Intuitive Interfaces
- New Opportunities by IoT familiar to Trainee
- Introduction of Massive Multiplayer On-Line Games
- New Web Games and Web Platforms
- Immersive Frameworks integrated in Education
- Games as New Learning Approach
- Mobile Training & Education





Human Behavior & Training Aids as...



Training Education

Frontal lessons

Learn by studying

Training on the job

Learn by doing

Simulation

Learn by exercising

Live

Constructive

Virtual

Serious Game

Learn by experiencing

Interactive approach to learning

Computer Based Training

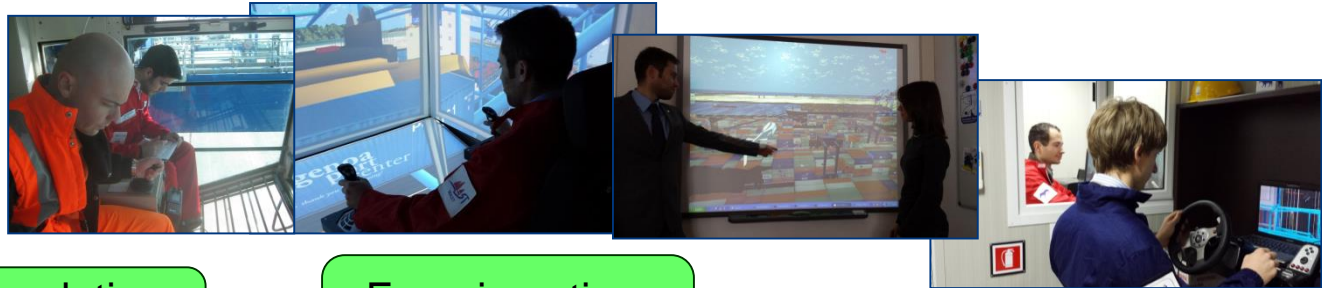


"Tell me and I forget. Teach me and I remember. Involve me and I learn.", Confucius



... Serious Games Evolve into Simulation Team Roadmap

Training on the Job



Simulation for Training

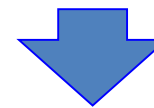
Experimenting on the Simulator

Serious Games for Training

Playing while Learning

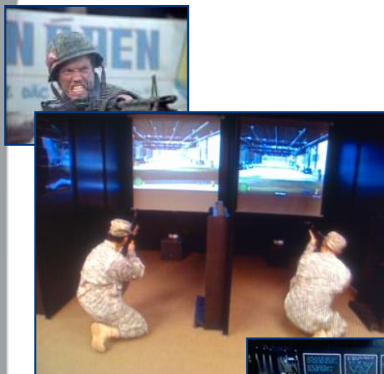
Experimenting on Games

Many More Installations
Many More Users



New Education Modes
New Utilization Modes

[Nuclear War]
..a strange game the only winning move is not to play
Joshua in War Games Movie



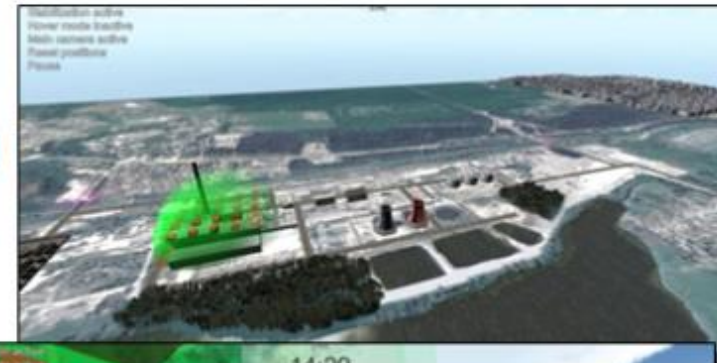


IDRASS

Immersive Disaster Relief and Autonomous System Simulation



IDRASS (Immersive Disaster Relief and Autonomous System Simulation) is a MS2G (Modeling, interoperable Simulation & Serious Game) operating in multiple modes: standalone, federated in HLA, integrated through IoT (Internet of Things) to support Education and Training. IDRASS has been applied to different cases including Accidents in Industrial Facilities, Nuclear Plants, CBRN attacks, anti-Terrorism, CWA and RDD. IDRASS is an interoperable real and fast time simulator.



RDD Radiological Dispersal Device
CWA Chemical Weapon Agent

DIME HLA High Level Architecture
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IDRASS

IDRASS simulates both operations indoor and outdoor within different industrial facilities (chemical and nuclear plants).

The use of IA (Intelligent Agents) is a fundamental resource for being able to develop realistic mission environments

IDRASS Simulates several Safety Issues:

- Obstacle Presence: cables, cable trays, pipelines, tanks
- Safety valves that could create challenging streams in terms of blast as well as temperature
- High temperature elements dangerous in terms of irradiations
- “natural” communication barriers, caused by reflection and interference of electromagnetic waves due to the high density of metallic infrastructures
- battery autonomy
- collision or indirectly by generating other accidents.
- time to complete the whole mission, especially when moving indoor and/or in confined spaces



IDRASS Simulator operating Autonomous Systems inside Industrial Plants



T-REX

Threat network simulation for REactive eXperience



T-Rex (Threat network simulation for REactive eXperience) is a MS2G (Modeling, interoperable Simulation & Serious Game) devoted to reproduce Hybrid Warfare and to be federated with other elements to evaluate the impact of these actions.

T-REX reproduces urban, as well as extra urban contexts over multiple domains including land, air, sea, space and cyberspace.

The models allows to consider media communications and

possibility to use different assets and to experiment virtually the different decisions in terms of COAs (Courses of Actions)

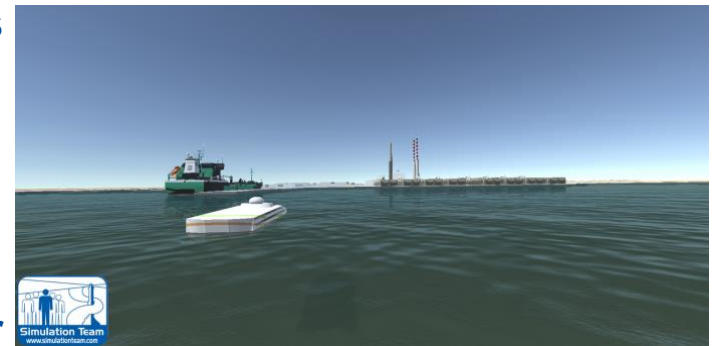




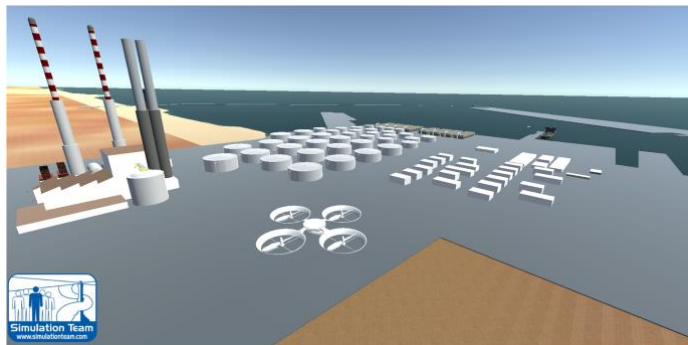
T-REX

T-REX simulator has been used to address different problems and involves combined used of UAV, UGV, USV and AUV to protect an industrial complex that provide strategic services (i.e. power, water, oil).

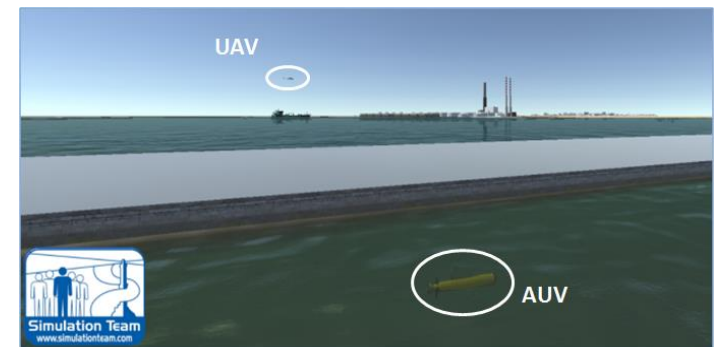
It is also possible to face sensor errors and failures that could reproduce critical conditions for simulating the problem of protecting of critical infrastructures by means of different UxV working in cooperation



T-REX combined protection of Port Framework by USV and other Autonomous Systems



UAV overview within Critical Infrastructure Protection Simulator, T-REX



AUV patrolling around the Critical Infrastructure in cooperation with UAV



SO2UCI

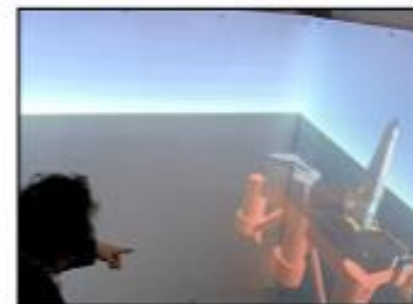
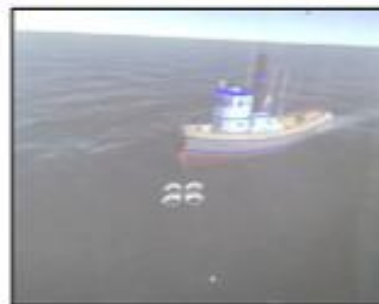
Simulation for Off-Shore, On-Shore & Underwater Critical Infrastructure



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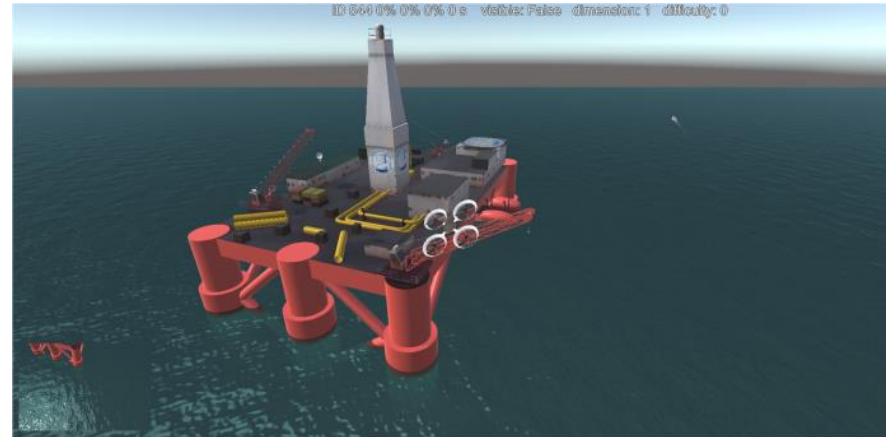
SO2UCI is a Simulation for Training on protecting Off-Shore Platforms (e.g. oil rig, gas rig), On-Shore Critical Infrastructures (e.g. ports, power plants, refineries, desalinators) and Underwater Critical Infrastructures (e.g. cables, pipelines) from Asymmetric Threats using conventional assets and autonomous systems (e.g. RHIB, Helicopters, Sensors, UAV, USV, AUV, Gliders, etc.). The simulator is interoperable by using HLA (High Level Architecture) and support integration with real equipment as well as with other simulators and solutions as the SPIDER. SO2UCI integrates scenarios for training the use of specific sensors on rotary wing UAV to discriminate suspect boats invading the perimeter of Oil Rig (e.g. face recognition, thermal camera, etc.)



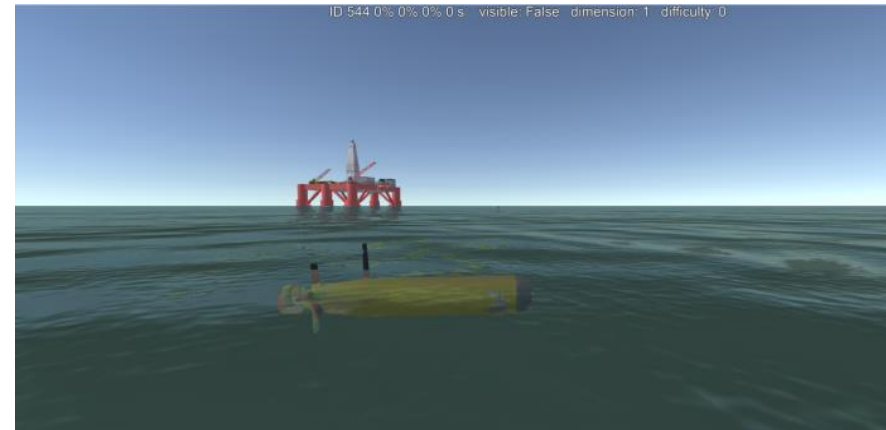


SO2UCI

SO2UCI allow to reproduce complex operations in Off-Shore Platforms. The environment inside and outside the rig is very challenging due to the complexity of the platform and to the extreme boundary conditions where it operates (e.g. sea and weather). Simulation of USV, UAV and AUV/UUV combined way, could be very usefu



SO2UCI with Drone supervision of the Off-Shore Platform



AUV in SO2UCI patrolling around the Off-Shore Platform



Strategic Engineering Concept

Strategic Engineering is a pretty new approach, emerging in Excellence Centers around the World, where New Technologies and Methods face Challenges & Uncertainty in Complex Systems



Strategic Engineering is the process of designing and analyzing New Solutions in order to achieve Strategic Results against *risks, uncertainty, competitors, threats and within critical environments*

Strategic Engineering is crucial to develop Modern Solutions for *Defense, Homeland Security, Government* as well as for *Industries, Companies, International Agencies & Public Authorities*



Conclusions

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It emerges that the new immersive technologies could enhance the capability of innovative simulators to be used in decision making at strategic level.

It resulted that many simulators with proper capabilities are already available to be used on the field operating with experts & companies.

There are favorable conditions to implement and develop models to support new critical area where the new MS2G could provide a strategic advantage as proposed by proposed cases such as T-Rex, JESSI and SIMCJOH

Based on these considerations the author are working on several concurrent project to test operationally with decision makers the enabling capabilities of ntroducing proper modeling approach.es



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... Questions?

