Simulation Team

MS2G as Pillar for developing Strategic Engineering as a New Discipline for Complex Problem Solving

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Simulation Team
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Strategos & Smart Computation Simulation

夫未戰而廟算勝者，得算多也；

未戰而廟算不勝者，得算少也；

多算勝，少算不勝，而況於無算乎？

吾以此觀之， 勝負見矣。

Sun

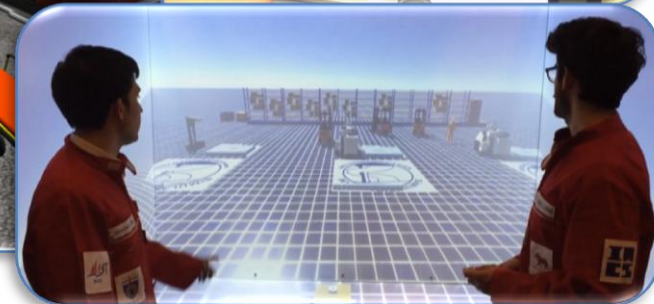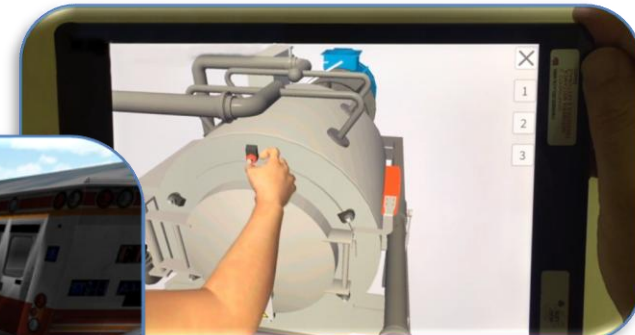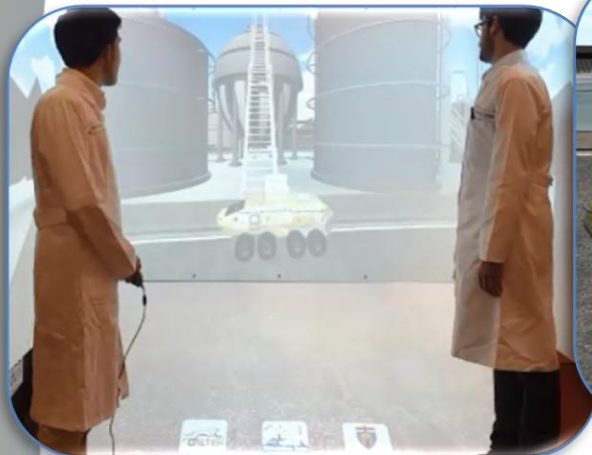*Now the general who wins a battle makes many calculations in his temple ere the battle is fought. The general who loses a battle makes but few calculations beforehand.*

Thus do many calculations lead to victory, and few calculations to defeat: how much more no calculation at all! It is by attention to this point that I can foresee who is likely to   win or lose. *Sun Tzu, Art of War, Laying Plans, 7, 500 BC*

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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
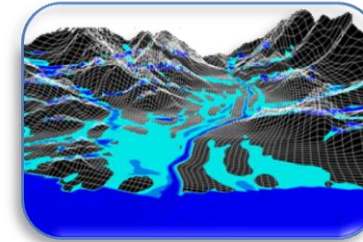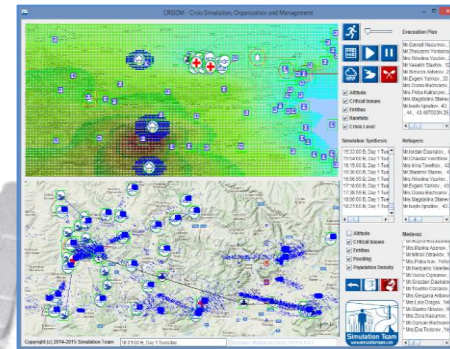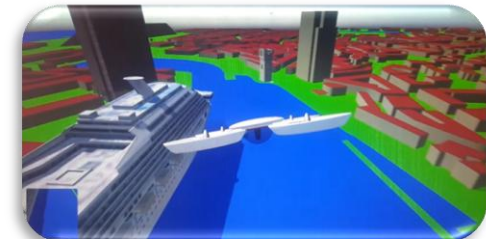
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MS2G Paradigm as new Enabler

MS2G

Modeling

interoperable Simulation

Serious Games

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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

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Example of Overall Architecture

AI & IA
Smart Planner

Man on the Loop

VR & AR
Real Situation

Manual & Automated Planning

Simulation

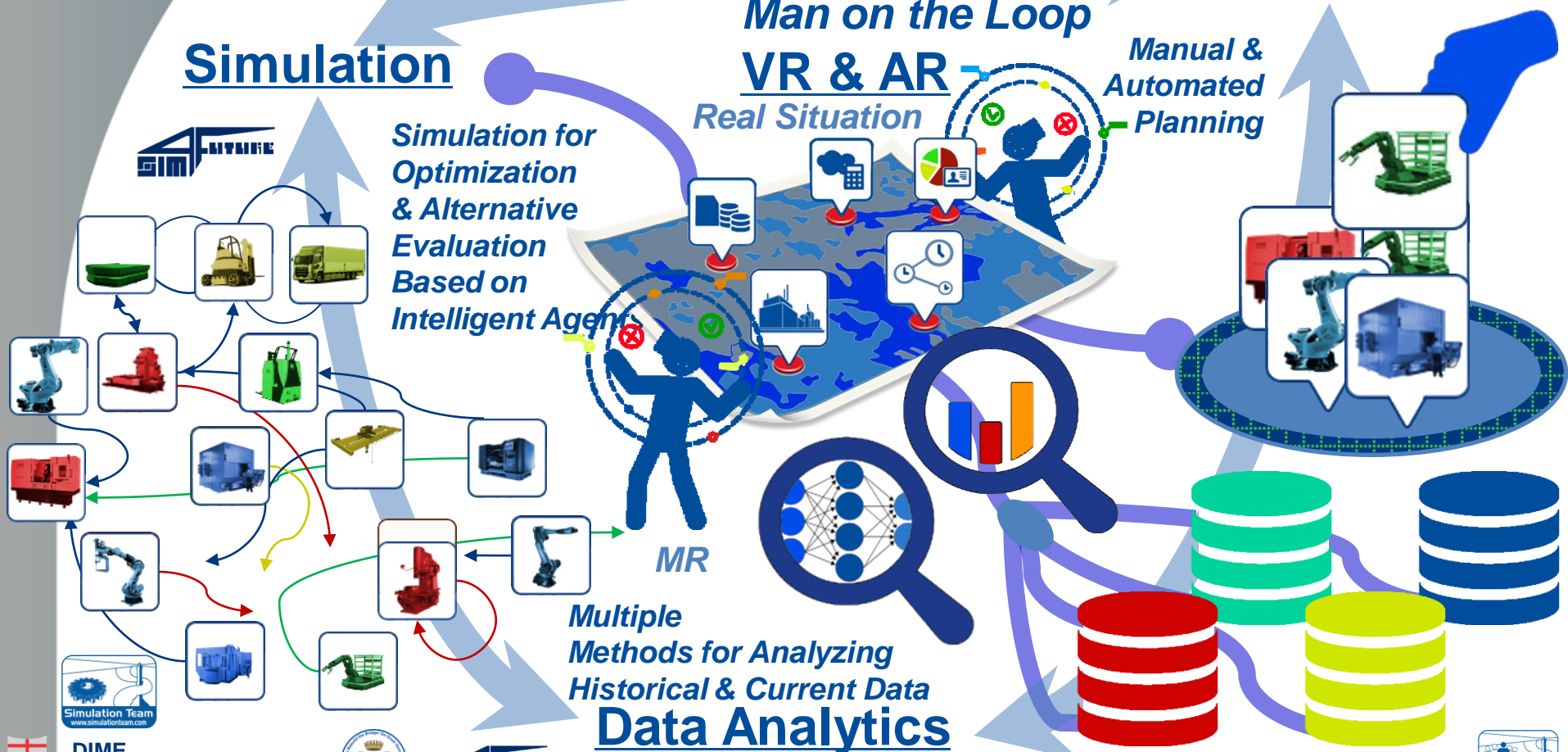*Simulation for Optimization & Alternative Evaluation Based on Intelligent Agents*

MR

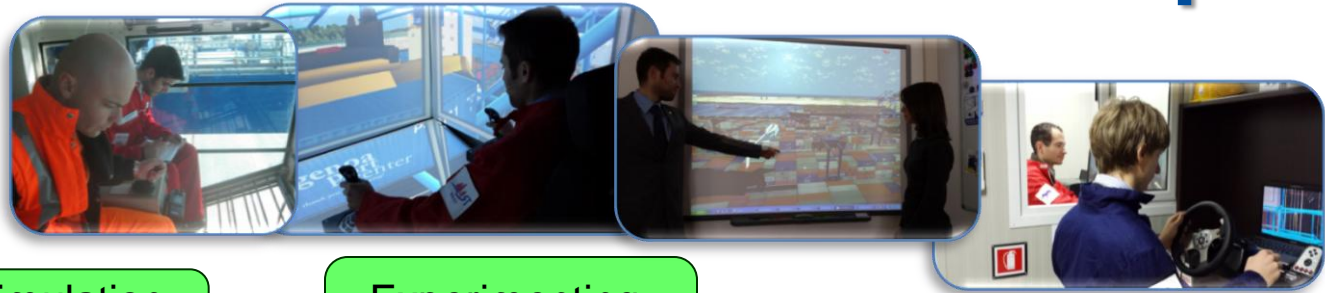*Multiple Methods for Analyzing Historical & Current Data*

Data Analytics

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… 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

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MMO   *Massively Multiplayer Online Game*
MMORPG   *massively Multiplayer Online Role-play Game*
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Strategic Engineering

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*

Strategy !?!

Classic Definitions: Strategy relies on effective plans able to achieve success in challenging situations such as business, politics, war, etc. **Strategy**, Greek word, combines *stratos (army)* and *ago (leading)*: Leading Resources

Gen.Jomini, Prècis de l'Art de la Guerre, 1838

*"La **Stratégie** est l'art de bien diriger"*

Von Clausewitz, Vom Kriege, 1832

*"We need a philosophy of **Strategy** that contains the seeds of its constant rejuvenation, a way to chart strategy in an unstable environment"*

&

*"**Strategy** is a system of expedients"*

Von Moltke, Militarische Werke, 1871

"No plan of operations extends with any certainty beyond the first contact with the main hostile force"

"Today, to be a great company, think about what Social Problem you could solve"

Ma Yun, Alibaba Executive Chair, in 2018: Personal Net Worth 42.2 GUSD; 23.8GUSD Alibaba Revenues 6.2GUSD Profits, 56% Net Revenues Growth, Stocks +15% in 1 month

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STRATEGOS:
Master Science in Engineering

A new Educational Degree in

Engineering Technologies for Strategy in Defense,

Industry, Government & Homeland Security in Companies

- **STRATEGOS** is the new International MSc (Master Science) in Strategic Engineering (Laurea Magistrale in Italia, 2 anni)

- **STRATEGOS** promotes Quantitative Modeling to Support Decisions by developing a new generation of Engineers able to deal with Strategic Thinking & Decision Makers

- **STRATEGOS** prepares Engineers for Decision Making providing strong foundation in Modeling, Simulation, Scenario Analysis as well as in Enabling Technologies
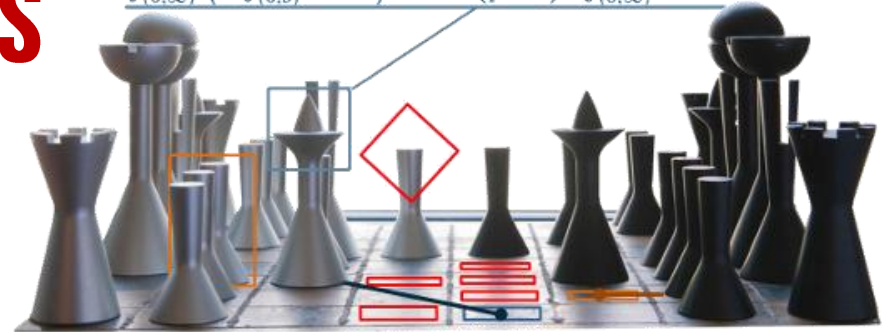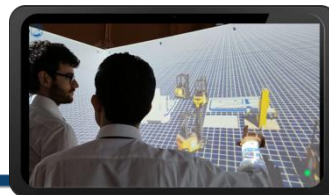
www.itim.unige.it/strategos

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STRATEGOS
Mission

$$\int_{(0,\infty)} \left(\frac{1}{s} \int_{(0,s)} h(t)\mathrm{d}t \right)^p \mathrm{d}s \leq \left(\frac{p}{p-1} \right)^p \int_{(0,\infty)} h(s)^p \mathrm{d}s.$$

STRATEGOS creates a New Generation of Engineers able to deal with Decision Making and Strategic Thinking in complex Scenarios

STRATEGOS prepares Engineers to master Modeling, Simulation, Enabling Technologies such as: Machine Learning, AI & IA, ICT, IoT & IoE, Big Data, MR, Data Farming, Data Analytics, Innovative Robotic and Autonomous Systems

AI   Artificial Intelligence
IA   Intelligent Agents
ICT Information & communication technology
IoE Internet of Everything
IoT Internet of Things
MR   Mixed Reality

DITEN

Changes around the World

- **How it is Changing the Industry & World?**
- **How Simulation enables to face new Opportunities?**
- **Way Ahead, Challenges and Opportunities**

← **2017!** →

Vs.

Black Hornet

Game

Reality

Some Open Questions?

- **How it is Changing the Industry & World?**
- **How Simulation enables to face Risks & Dangers?**
- **Way Ahead, Challenges and Opportunities**
- **To Perish is just a Game Option... or is it Real?**

← **2017!** →

Vs.

Opportunities

Tianijin Explosion, August 2015, 800 tons Ammonium Nitrate, 173 casualties, 2km range, 9bUSD Ins.Damage

Threats

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Some new way to… Perish!

18 millions of Taxi Drivers Worldwide

- 1995 Mercedes from Munich to Denmark, 1600 km
- 1996 Parma University follow lane marks, 1900 km
- 1997 NAHSC, 20 vehicles in I7 San Diego
- 2004 DARPA, failure on running in the Desert
- 2005 Parkshuffle near Rotterdam
- 2007 DARPA, urban challenge won by Chevy CMU
  .
- 2014 Vislab 20' in Rush Time →30M$ by Ambarella
- 2016 Daimler AG smart parking in Stuttgard HQs
- 2016 Tesla first Casualty
- 2016 Nutonomy in Singapore, Self Taxi Service
- 2016 Uber testing in Pittsburgh
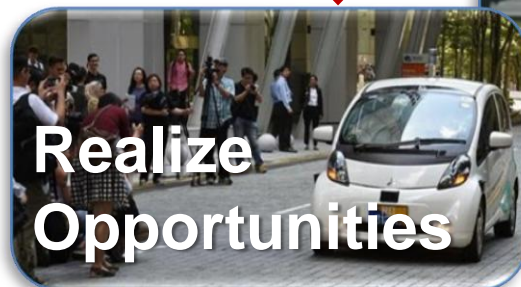- 2017 Uber banned in London after Vancouver & Austin

900'000 Truck Drivers In Italy

looking for a job

200'000 Uber Drivers Worldwide

CMU	Carnegie Mellon University
DARPA	Defense Advanced research Projects Agency
NAHS	National Automated Highway System Consortium

2015 Statistics

Realize Opportunities

Face Risks

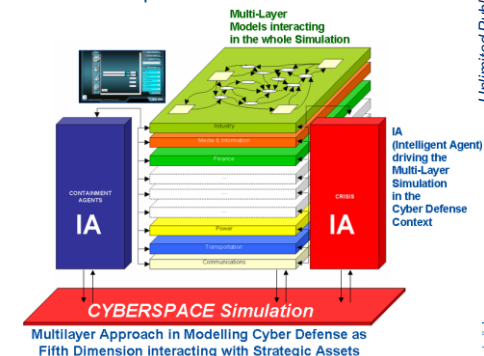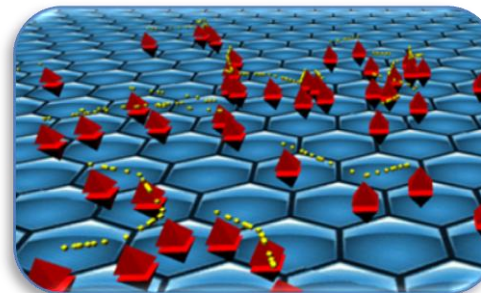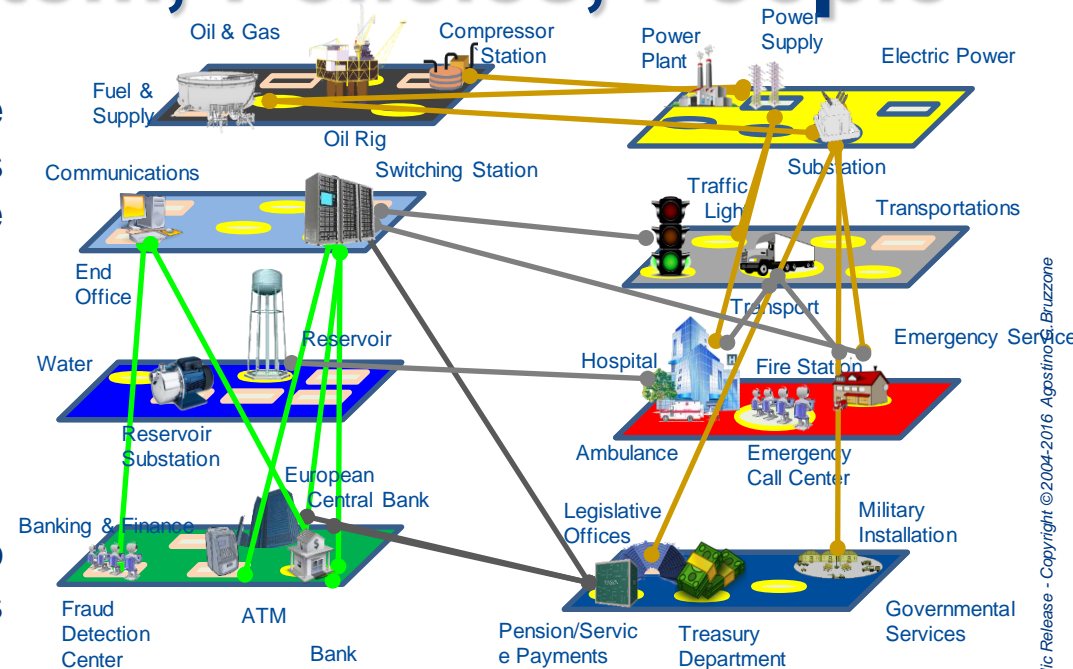**Challenges**

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Multi-Layer Simulation for New System, Policies, People

The Modern Systems are usually addressing Multiple Layers and requires to consider multiple aspects for developing

- New System Design

- New Policies & Procedures

- New Technologies and Processes

- Table Top Exercise in order to understand and raise awareness by Human and Machine Learning

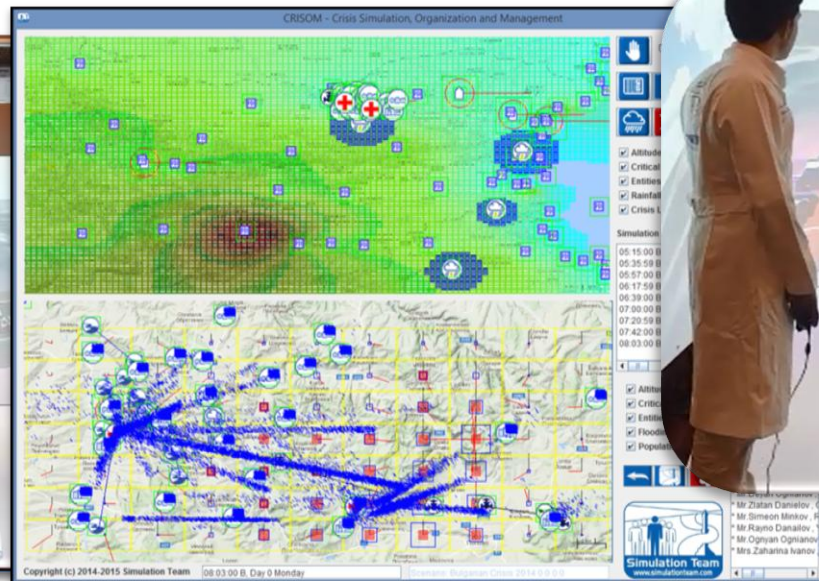- Education & Training Programs for Multiple Players

The use of AI & Intelligent Agent is crucial to automate Smart Simulation

Multilayer Approach in Modelling Cyber Defense as Fifth Dimension interacting with Strategic Assets

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Simulation Team   *Non Sensitive Information, Distribution Unlimited*
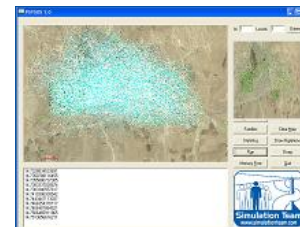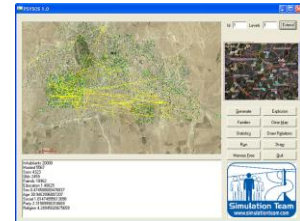
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MS2G and IA-CGF

The MS2G (Modeling, interoperable Simulation and Serious Games) could be combined with use of IA (Intelligent Agent such as IA-CGF by Simulation Team). The Intelligent Agents simulate concurrently many actors, people and actions enabling to recreate and study very complex scenarios to improve trainee engagement

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Simulation Team
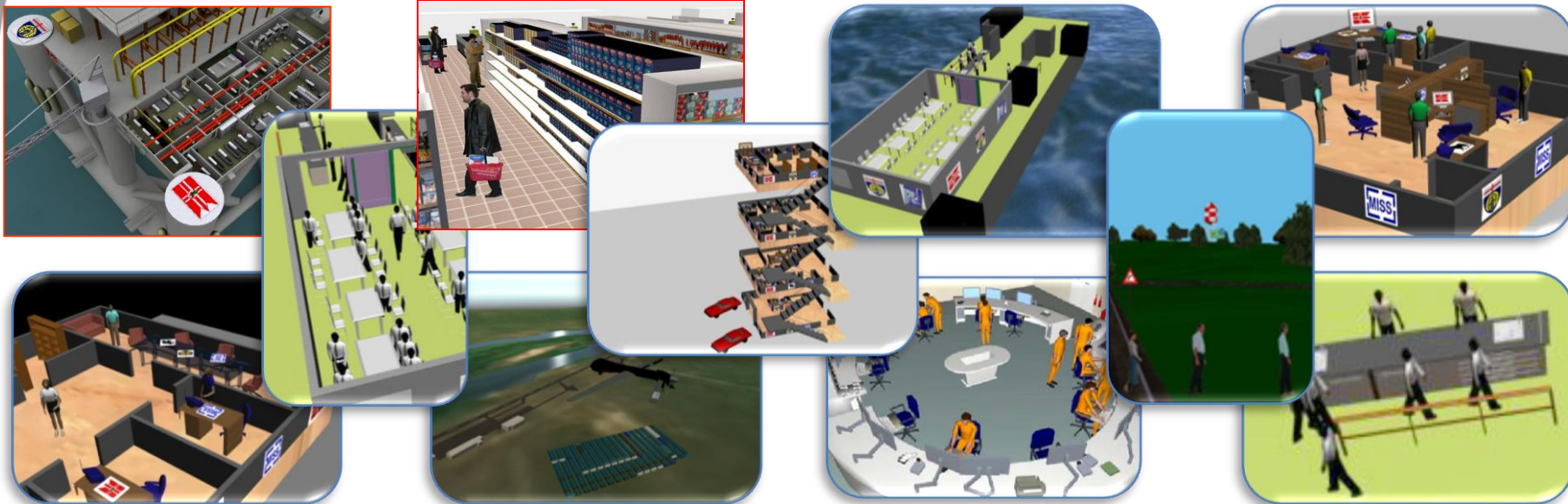
Agent Directed Simulation Benefits

- **Simulation of Complex Behaviors related to People, Organizations, Entities and Resources**
- **Experimentation with a reduced workload thanks to the agents autonomous behavior able to replace man-in-the-loop and help in scenario setup**
- **Execution of large number of simulation runs and replications**
- **Allow collective training with limited Personnel**
- **Investigation of New Policies and Regulations on the Simulation**
- **Achieve a greater accuracy and reliability of simulation results in the case of experimental analysis and training**
- **Set-up a greater number of exercises given the same amount of available resources**
- **Support Expert Contributions and Creativity by operating over Realistic and Reactive Simulation Frameworks**

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Intelligence to Simulate Humans as well as to Interact

The data flows, business processes are usual crucial in systems. The _Human Behavior Models_ (_HBM_) are required to enable Smart Simulation in order to reproduce people, organizations, companies, cities,, so it is very important to use Intelligent Agents to reproduce these elements & their interactions

Benefits from *IA-CGF*

Intelligent Agent Computer Generated Forces

- **Introduction of Composable Elements in the Simulation Environment**
- **Reduction of Workload for Experimentation**
- **Speeding Up Scenario Preparation**
- **Supporting Data Farming and Experimental Analysis**
- **Simulate Complex Non-Conventional Asymmetric Scenarios**
- **New Capabilities to evaluate Impact of Second Effects**
- **New Sparring Partners**

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Lets look at some Examples…

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Lets look at some Examples…

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Lets look at some Examples…

Working on Real Virtual Worlds

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IA-CGF for Large Systems & Huge Interactions

PANOPEA (Piracy Asymmetric Naval Operation Patterns modeling for Education & Analysis) has been developed by Simulation Team to Simulate complex situations where traffic is so intense that is hard to Coordinate Operations and discriminate threats and alerts

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Haiti Humanitarian Support Demonstration

The demonstration was devoted to show the potential of interoperability in combining different simulators for full coverage of a complex problem such as that one of Haiti. Simulation Team was involved by using his interoperable IACGF reproducing Population Behavior, Human Factors (famine, stress, diseases, fear, aggressiveness), Riots and Gang Activities as well as the impact of the Simulation Earthquake

JTLS
JCATS
IA-CGF Riots
IA-CGF EQ
VBS2
DI-GUI
PLEXSIS

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UxV & Plants…
…and more!

Inspection Outside

Inspection Inside

UxV Unmanned any domain Vehicle
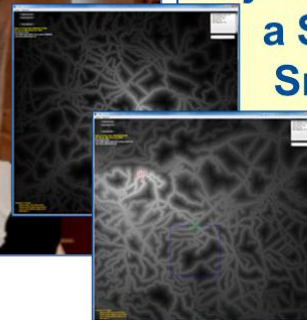

Safety First

AI & Man on the Loop vs. Man in the Loop

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Humans need new ways to interact with Intelligent Systems.
Today we need to pass from driving and piloting a single UAV to assigning high level task and objectives to a Wing or a Swarm of Uxv.
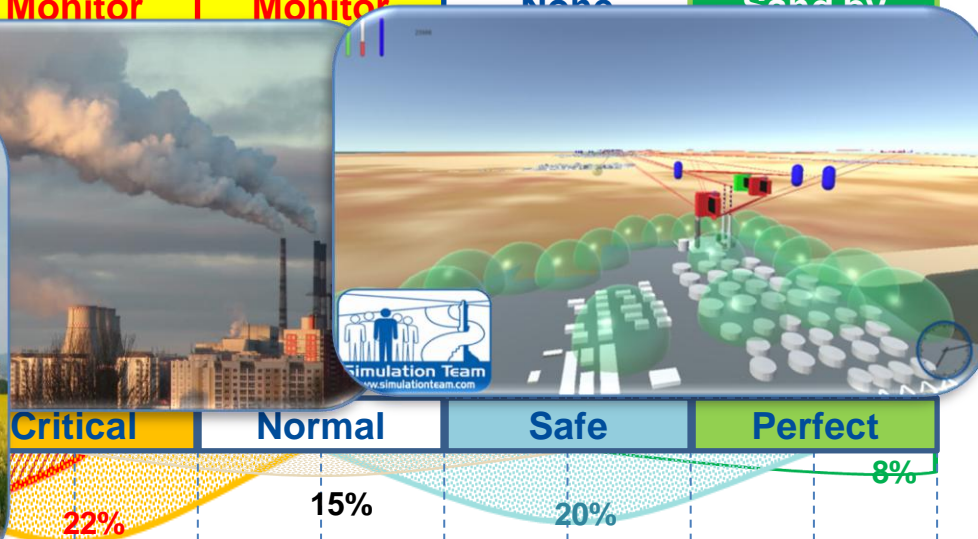Smart Simulation allows to Design, Experiment & Test these new Solution

AI… Artificial Intelligent for Awareness driven Initiatives

General Situation on the Plant

Danger	31.5%
Inspect	35.2%
Monitor	23.3%
Stand by	8.0%

Mutual Relationship among Sensors & UxV

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MS2G supporting us during good times..

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…and during Crisis and Critical Conditions

We need Smart Simulation in Engineering
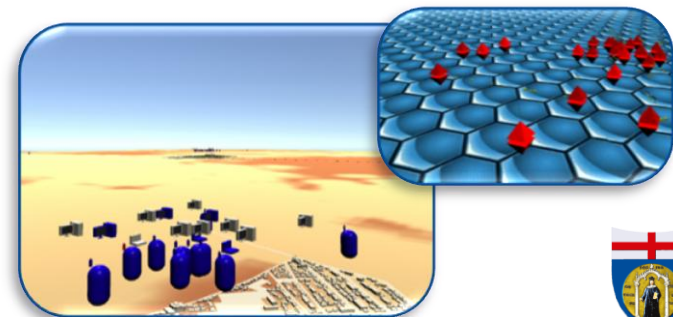# …because things are Changing!

Cyber Domain: adding Spices to T-REX

Threat network simulation for REactive eXperience

The Cyber Security is part of T-Rex environment and allows to evaluate the impacts on operations and estimates their magnitude This approach allows to considerate the Cyber Domain Complexity and the impacts on ICT process and infrastructures as well as Social Engineering elements. The MS2G (Modeling, interoperable Simulation & Serious Games) approach, make possible to raise users awareness and improve performance reducing vulnerabilities

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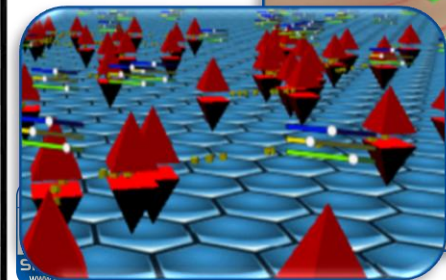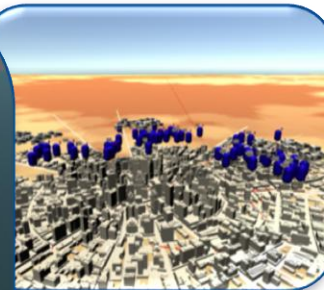
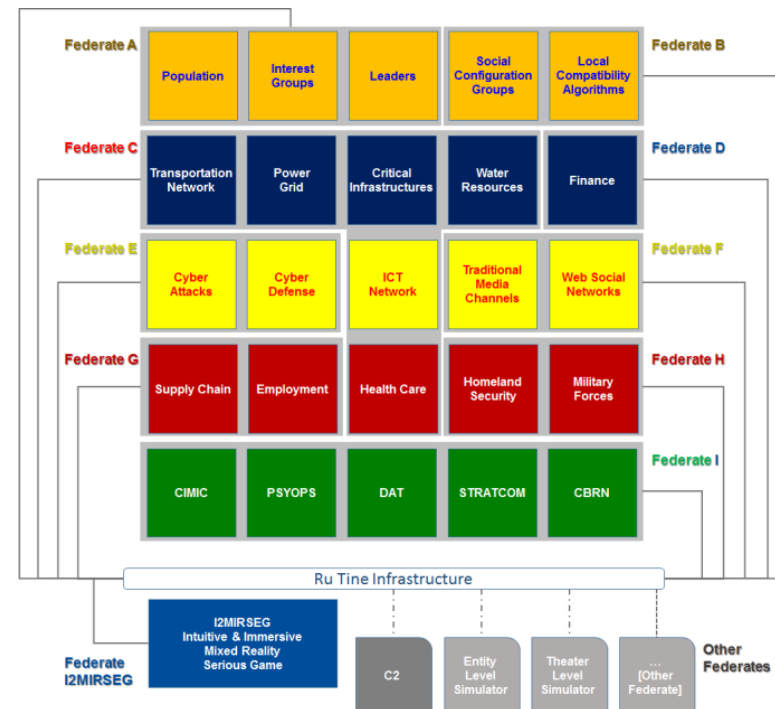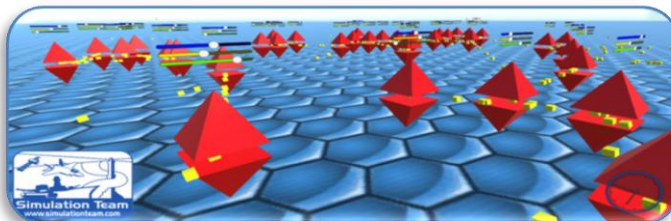**Simulation Team**

Hybrid Challenges & Autonomous 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

Creating Comprehensive Environments

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New Frontiers &…

There are Sharks in these waters?

Yes, there are Sharks in all Seas!

Cyber is … Everywhere

88 Shark Attacks *World/year*
5 deaths in 2017

230'000 Malware produced by day
77'183 Cyber Severe Damages
Cyber Insurance Premiums 1.3bUSD
Cyber Security Gov.Budget 28bUSD
…just USA …already 3 years ago

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New Frontiers &…
…New Engineers

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New Frontiers &… …New Engineers

September XIII, 2018, 0607 Z

Cyber Attacks are able to disable official websites and networks, disrupt or disable essential services, steal or alter classified data and cripple strategic assets & critical infrastructures such as Communications, Power, Transportations, Finance, Health Care.

Cyber Attacks are addressing both **Civil** and **Military Targets**

Cyberwarfare is a Cyber-based Conflict involving motivated attacks on information and information systems.

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New Frontiers &…
…New Engineers

Big Data are a resources also for Attackers in Cyberspace

- **Yahoo 2013 & 2014, Over 1 billion accounts**
- **TJX, 2003, 45.7 million credit/debit cards, driver's licenses**
- **FriendFinder, 2016, 412 million accounts on dating**
- **Ebay, 2014, 145 million accounts**
- **Heartland Pay.Syst, 2008/2009, 130 million credit cards**
- **Target Stores, 2013, 110 million records compromised**
- **Sony OE., 2011, 102 million records compromised**
- **Anthem, 2015, 69 million health insurer records**
- **Home Depot, 2014, 56 million credit and debit cards 10.5 GUSD (~194 USD/card)**
- **LinkedIn, 2012, 6.5 million accounts (4%), password cracking in 72h for 90% cases**

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New Frontiers &…
…New Engineers

MiTM Man in The Middle   Dsniff Dug Song Sniff through SSH & HTML by MiTM

It is not necessary to attack your PC or Mobile…

… new Kitchen Appliance provide new vulnerabilities:

- **To get your Google Account by MiMT from a Fridge able to propose you the Google Calendar (2015)**

- **To generate a Junk Mail Campaign spamming 750'000 emails from 10'000 Home Devices (2014)**

- **To watch your home from Always On Camera from Smart TV (2015)**

Smartv Federal Trade Commission

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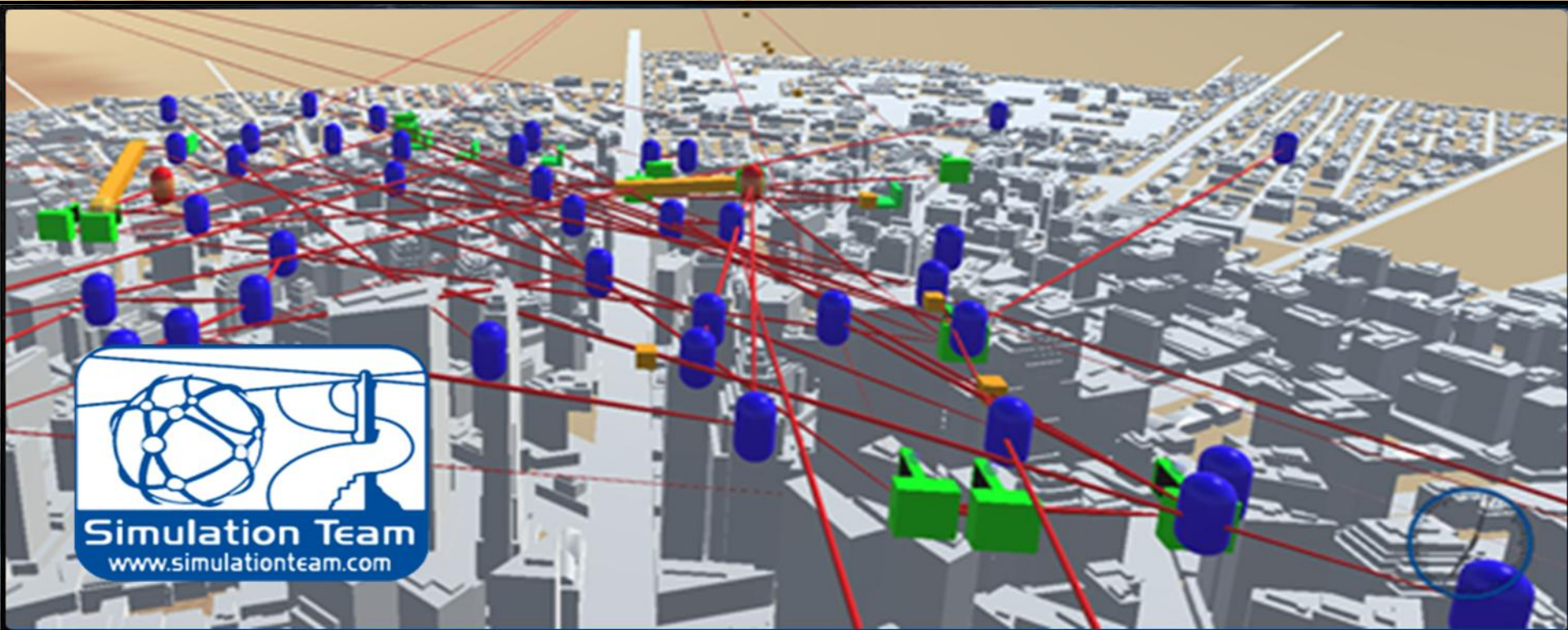Simulation Team

New Frontiers &…
…New Engineers

- **Estonia, April 26-May 23, 2007, DDS, Botnet, Ping floods: All Government, 2 Banks, Political Parties, No Parliament Email, No Credit Cards, no ATM**
- **Georgia, August 7-12, 2008, DDS, Botnet, Web Defacement, Sql Injections, Spamming: News and Government Websites Down, Gov.Comms down with the World, Banks & Cell Phones down.**
- **Kyrygistan, January 18-31, 2009, DDS, ¾ IPS down, 80% internet down, mobile down**
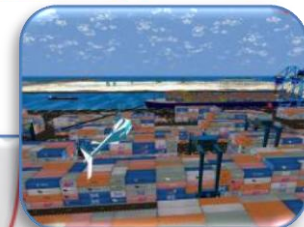- **Ukraine, 2015/2017, SCADA, Blackouts 1/million People 2h**

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New Frontiers &…
…New Engineers

New Frontiers &…
…New Engineers

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