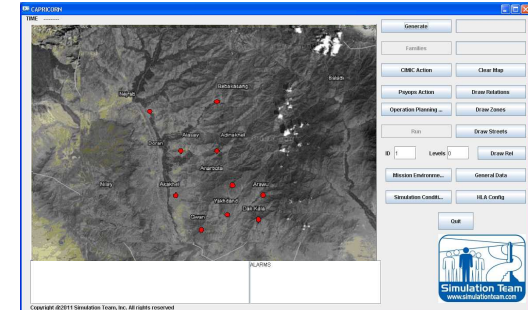




# CAPRICORN



## Cimic And Planning Research In Complex Operational Realistic Network



[www.liophant.org/projects/capricorn](http://www.liophant.org/projects/capricorn)

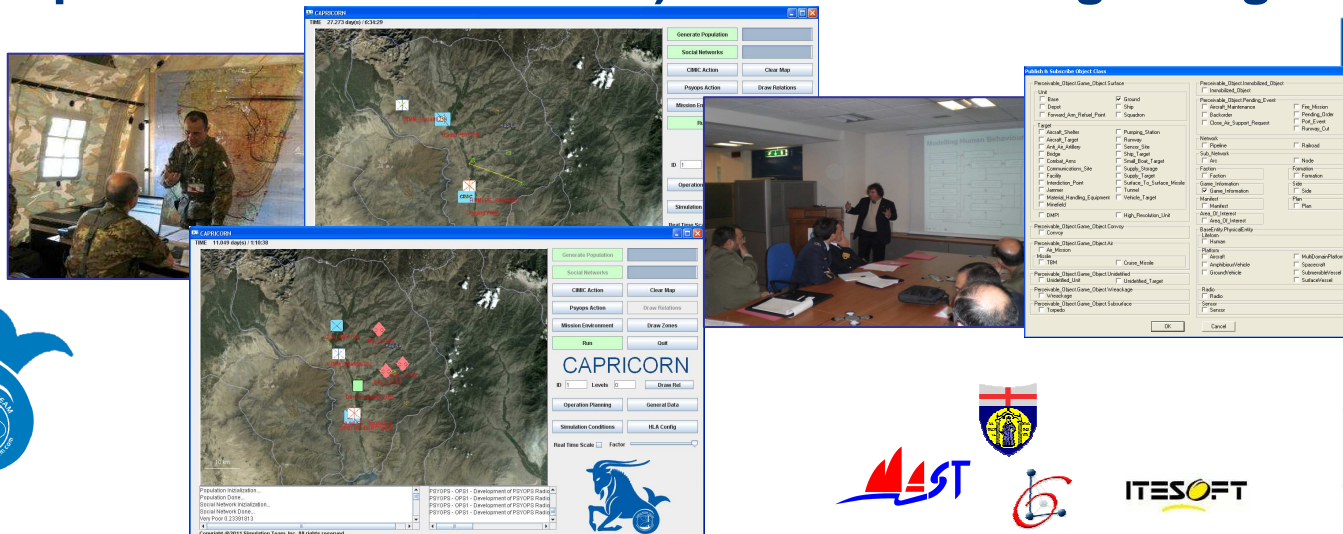




# CAPRICORN

*Civil Military Co-operation And Planning Research in Complex Operational Realistic Network*

- CAPRICORN is an EDA R&D Project devoted to develop capabilities in the complex and critical sector of Military Operation Planning, specifically for asymmetric warfare scenarios involving CIMIC and PSYOPS, by using CGF (Computer Generated Forces) based on Intelligent Agents (IAs)



DIPTM  
Università di Genova

Unclassified



LSIS  
Marseille



ITESOFT



MAST





# CAPRICORN Outcomes



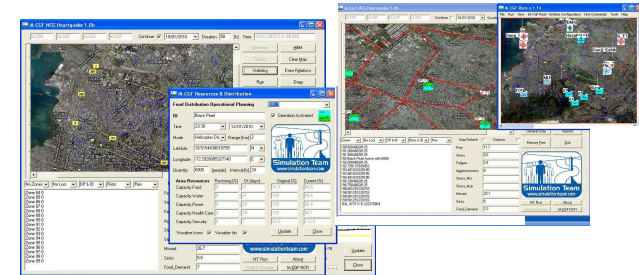
**CAPRICORN Main Outcomes are:**

- ◆ **Investigation on the use of Intelligent CGF and Simulation for Operational Planning**
- ◆ **Advanced Human Behavior Hierarchical Models for Intelligent Agents and CGF**
- ◆ **Enhanced Interoperable Multilevel Models for Operational Planning**
- ◆ **Demonstrating Simulation Models of CIMIC & PSYOPS**

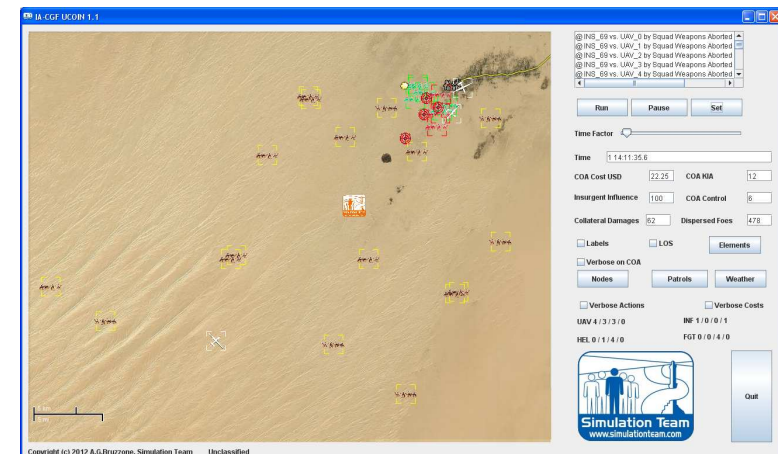




# CAPRICORN as Evolution of IA-CGF



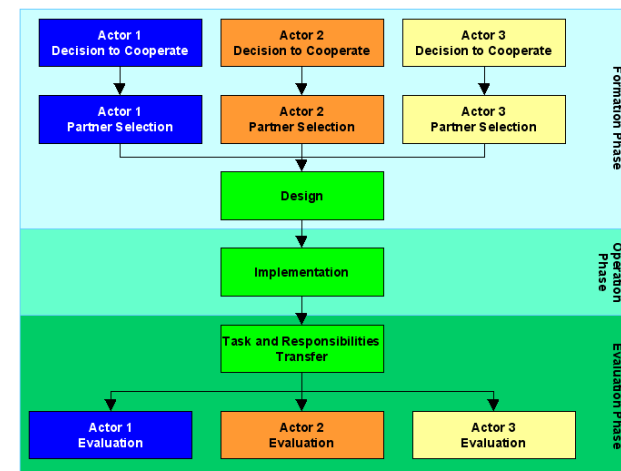
- CAPRICORN is based on IA-CGF (Intelligent Agent – Computer Generated Force) developed by Simulation Team and applied in multiple sector (i.e. IA-CGF UCOIN, EQ, Riots).
- CAPRICORN gets benefits from previous researches related in other projects about civil disorders (i.e. PIOVRA Project)
- CAPRICORN looks forward for moving the IA to Operational Planning developing new innovative models (i.e. CIMIC, PSYOPS) and extending coverage of critical aspects (i.e. Human Behavior Modifiers and Cultural Issues) for Intelligent CGF.





# CIMIC Military Relevance & CAPRICORN Project

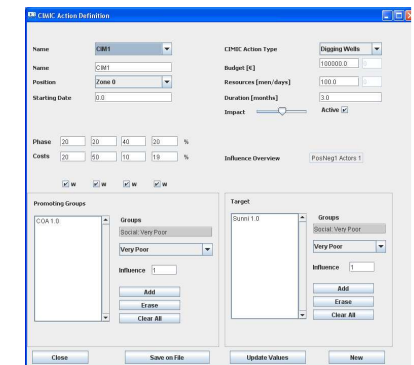
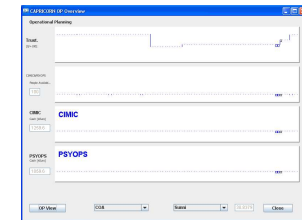
- *The CIMIC type activities now days constitute a significant portion of the total military effort. The forces engaged in operations not Art. 5, both for their value in the territory that for the external visibility of the operations themselves, are under the world opinion evaluation.*
- *CIMIC are critical issues in S&R (Stabilization and Normalization) operations as well as during Stabilization and Normalization phases of most of current scenarios.*
- *CAPRICORN Project is focused on creating new CGF for simulation of CIMIC able to consider key operational and territorial factors also in the planning and exercises stages.*





# CIMIC Objects

- In the CIMIC scenario Comportment Objects reproduces:
  - Population
    - Ethnic Groups
    - Cultural Layers
    - Social Layers
    - Local Communities
  - Public Institutions
    - Governmental Entities
    - Local Administrations
    - Schools
    - Health Care Systems
    - Political Parties
  - Military Organizations
    - Local Army
    - Allied Forces
    - Opposite Forces
    - Neutral Forces
    - Paramilitary Organizations
    - Police Forces
    - Warlords
    - Insurgents
    - Terrorists





# PSYOPS Simulation

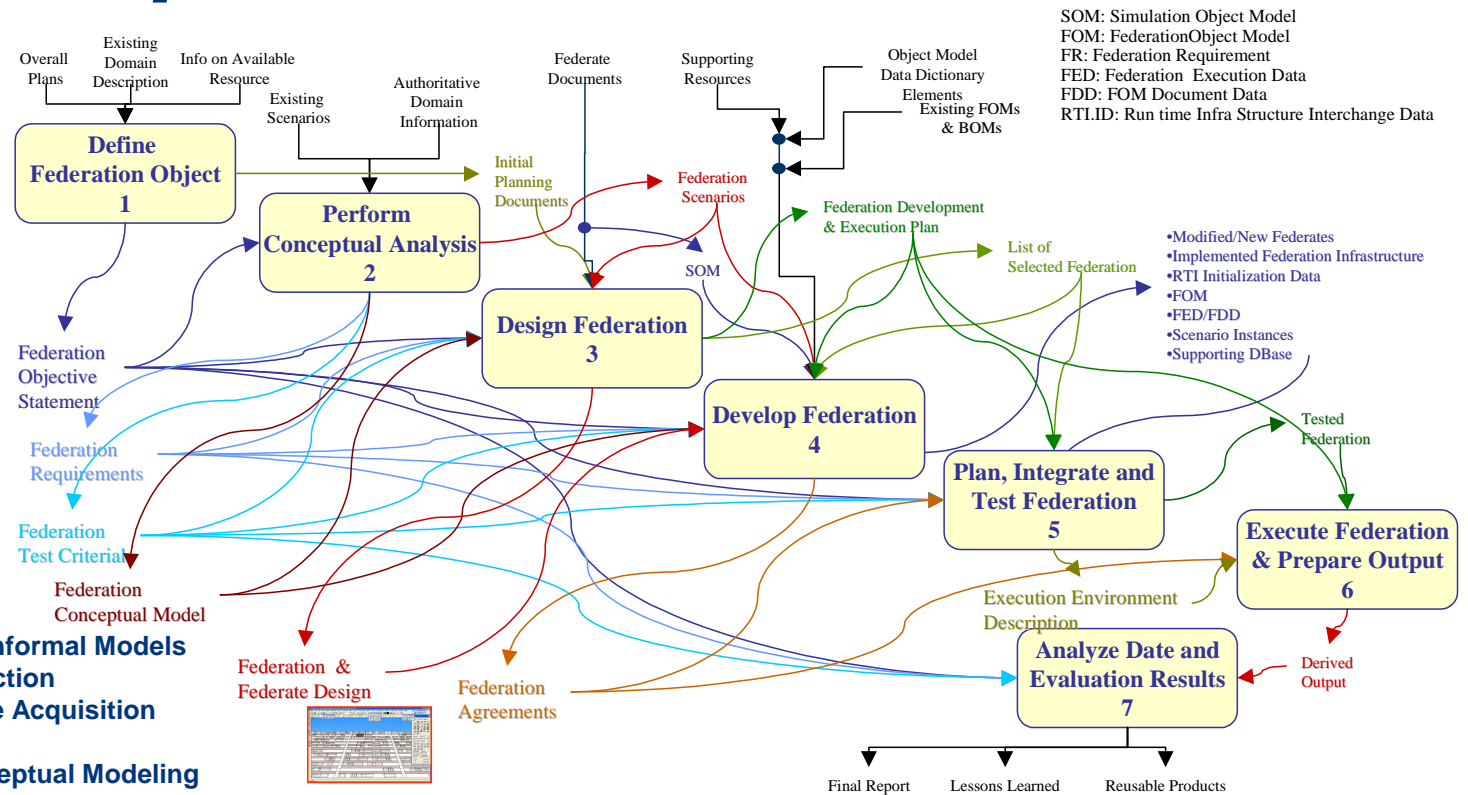
- CAPRICORN includes Models of different types of PSYOPS:

The screenshot displays the CAPRICORN Mission Environment software interface. The main window shows a 3D terrain map with various PSYOPS units and actions. Overlaid windows include 'CAPRICORN Mission Environment' with buttons for Configuration Group, Group Relationship, Terrain, Areas, Entities, Weather, DEM, Groups, Needs, Leaders, and Criteria. Another window shows 'PSYOPS Action Definition' with fields for OPS1, OPS2, Zone 2, Duration, Impact, Sender Credibility, Info-Target Receptivity, and Influence Overview. A third window shows 'Promoting Groups' with a list of groups like 'Social: Very Poor' and 'Very Poor'.





# Steps in Simulation Creation



**Knowledge Collection & Informal Models**  
 Data Collection  
 Knowledge Acquisition

**Simulation Oriented Conceptual Modeling**  
 State Space  
 G-DEVS/HLA

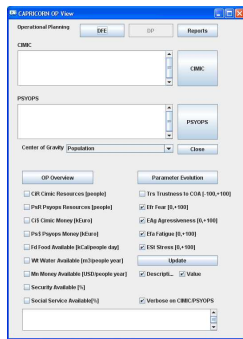
**Simulation Implementation**  
 Demonstration Development  
 Execution  
 Data Analysis



## General Scheme of CAPRICORN Development Process



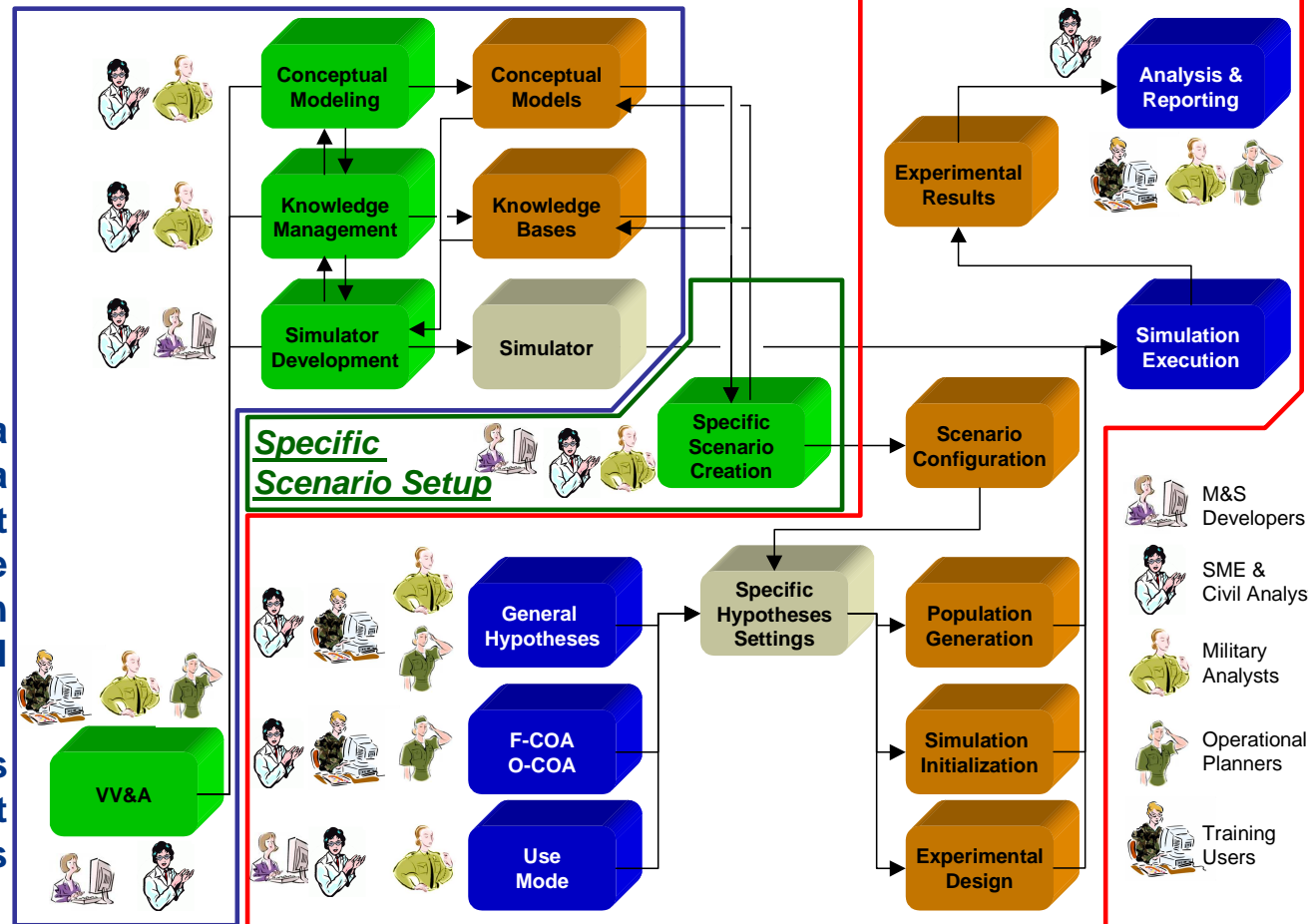
# CAPRICORN Processes & Key Elements



CAPRICORN requires a specific phase to set up a New Mission Environment as Scenario to be simulated by Users on different geo-cultural areas

Therefore the User is able to change and test his hypotheses about this new context

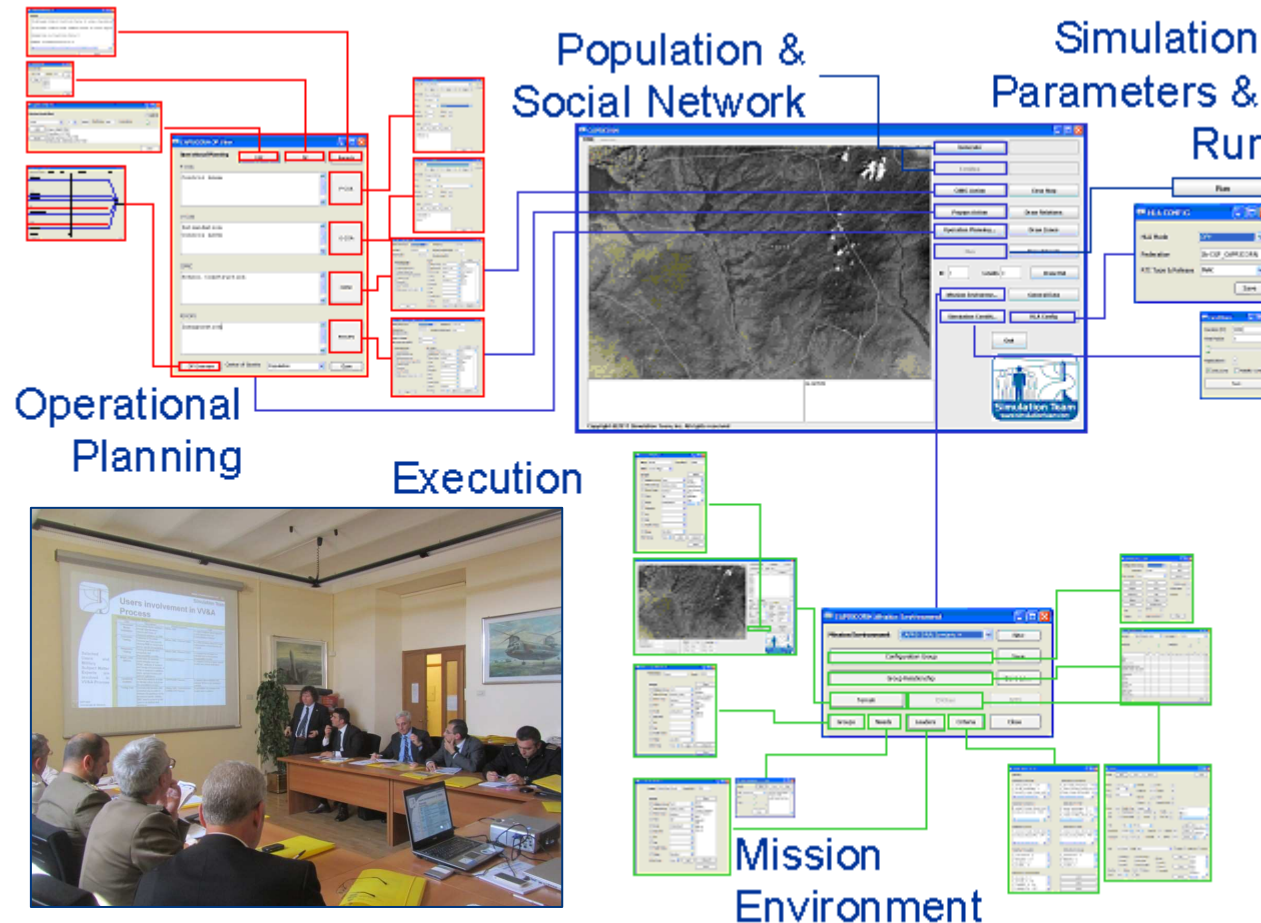
## Simulator Development



# CAPRICORN Demonstrator Element Architecture



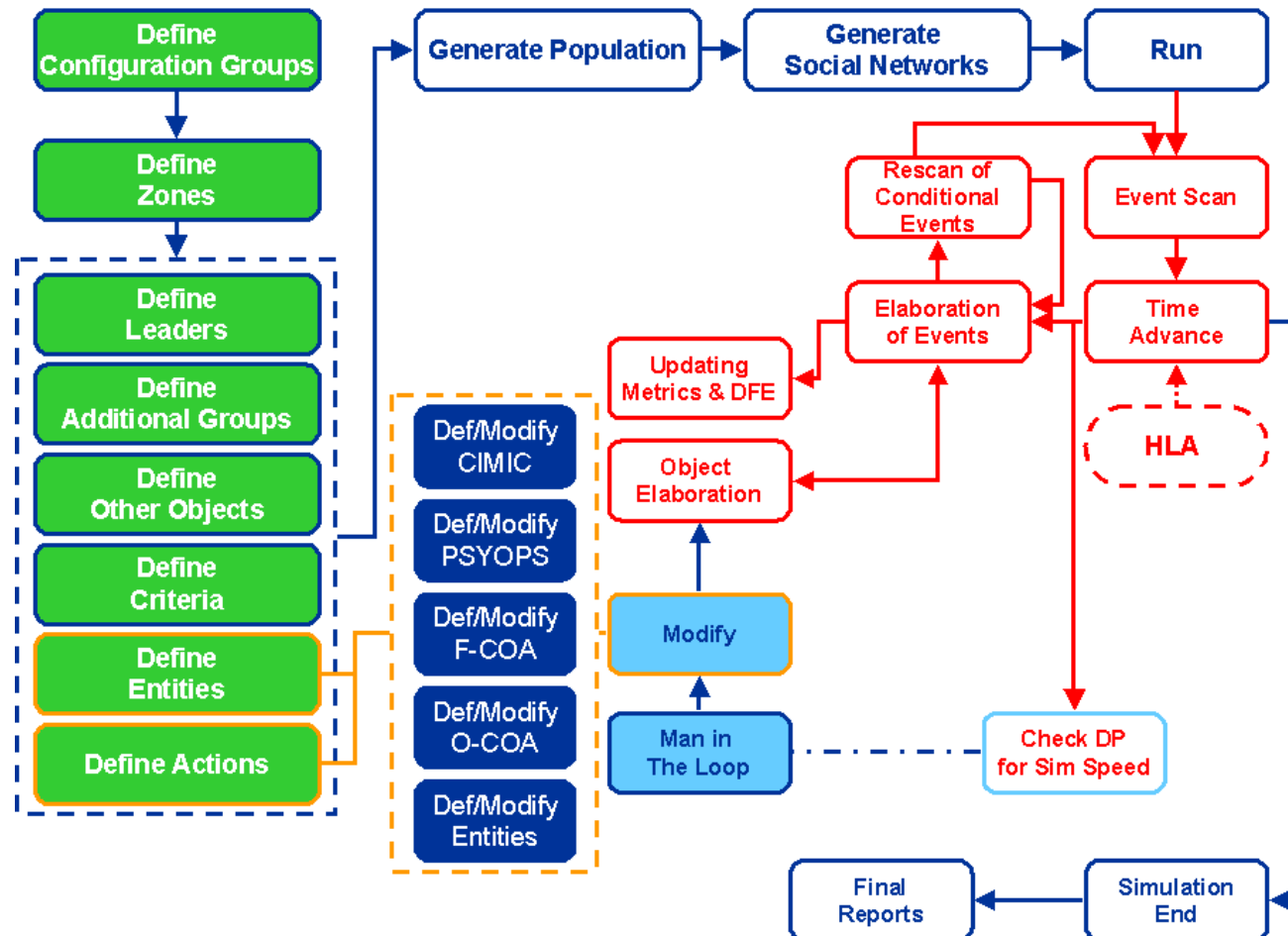
**CAPRICORN**  
Users are entitled to modify the Mission Environment, define the operational planning, simulating the operations as well as the population behavior and the impact of entities and units on that area





# CAPRICORN Demonstrator Function

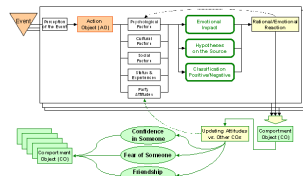
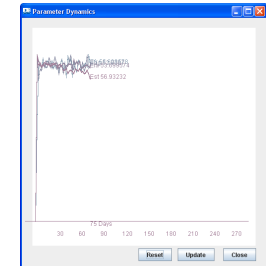
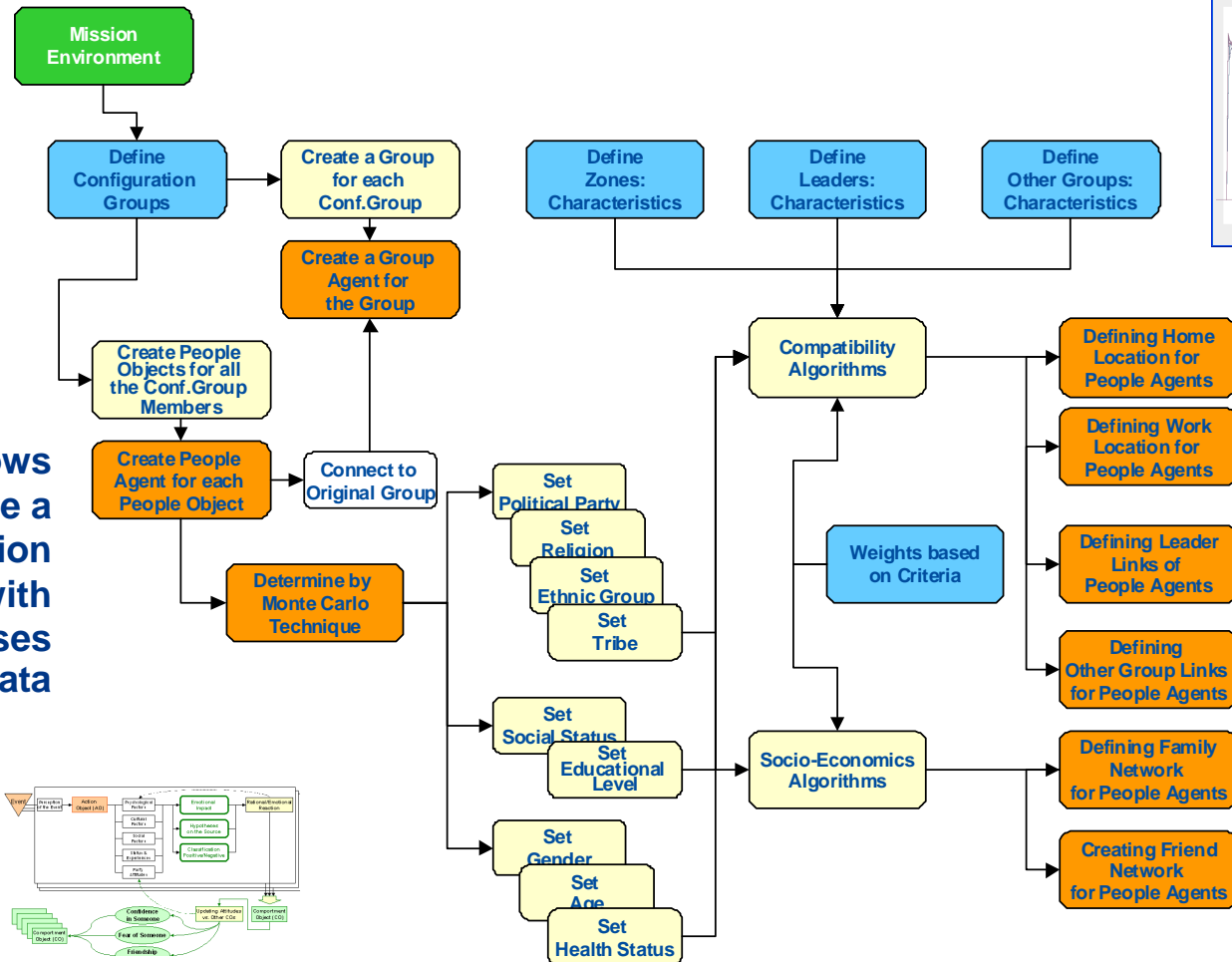
CAPRICORN Functions include different services and alternatives for creating and executing the Scenario





# CAPRICORN Population Generation Process

CAPRICORN allows to generate a population consistent with user hypotheses and statistical data





# Human Factors in IA-CGF

The image displays several overlapping windows from the IA-CGF simulation tool, each showing a different category of parameters with sliders and numerical values:

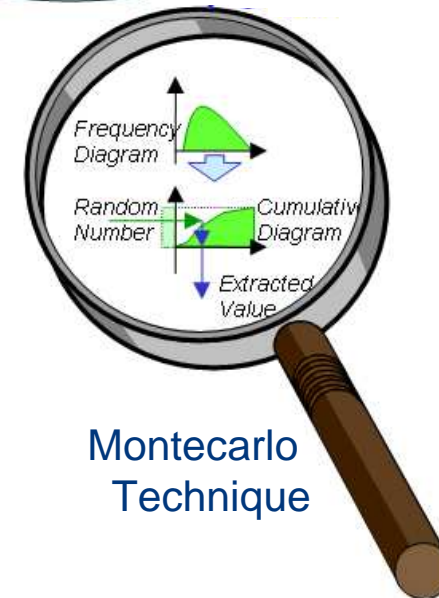
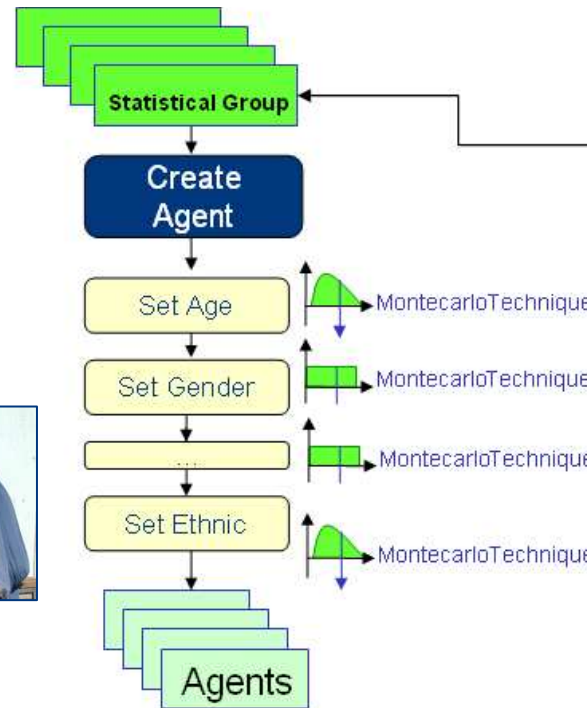
- Tribe:** Safi Pashtun (0.22), Pashtun (0.62)
- Ethnic:** Pashtun (0.6), Tajic (0.87), Hazara (0.90), Uzbak, Aimak
- Social:** Unemployed, Poor, Farmer, Worker
- Party:** Pashtun\_Party (0.554), NewAfghanistan... (0.717), Wahdat\_Islamic... (0.834), National\_Islamic... (1.0)
- Education:** Elementary (0.40), Middle School (0.98), High School (0.99), University (1.0)
- Age:** 0-14 (0.436), 15-65 (0.97), >65 (1.0)
- Sex:** Male (0.487), Female (1.0)
- Religion:** Sunni (0.8), Shia (0.99), Other (1.0)

Each window includes a 'Save', 'Restore', and 'Uniform' button, and some have a 'Discreat' button. The background features a large, faint question mark icon.

IA-CGF allows to define social, ethnic, religious, political, clan, educational, health status and physiological hypotheses on each specific group of the population.



# Population Generation by Montecarlo Techniques



Montecarlo Technique

IA-CGF Generate the whole population of the region and the related social networks based on available data



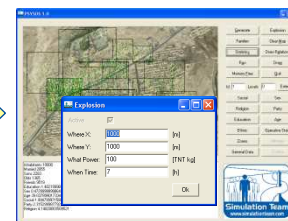
# IA-CGF: Populating the Scenario for the Simulation



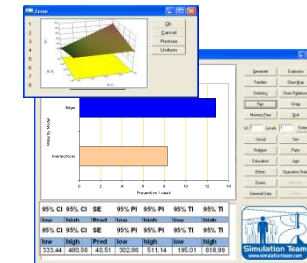
Specific Mission Environment



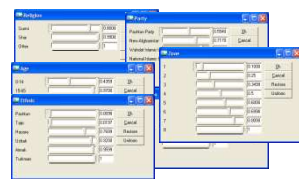
Generate Social Networks



Define COAs, Metamodels Actors of Threat



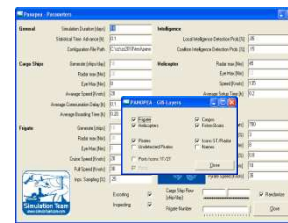
Comparative Analysis & Result Synthesis



Population & Social Network Configuration



Generate Population

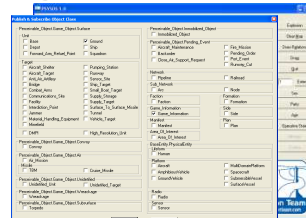


Setting Simulation Parameters



Simulation Execution

CIM-HLA



Setting Interoperability HLA Mode



Other Federates

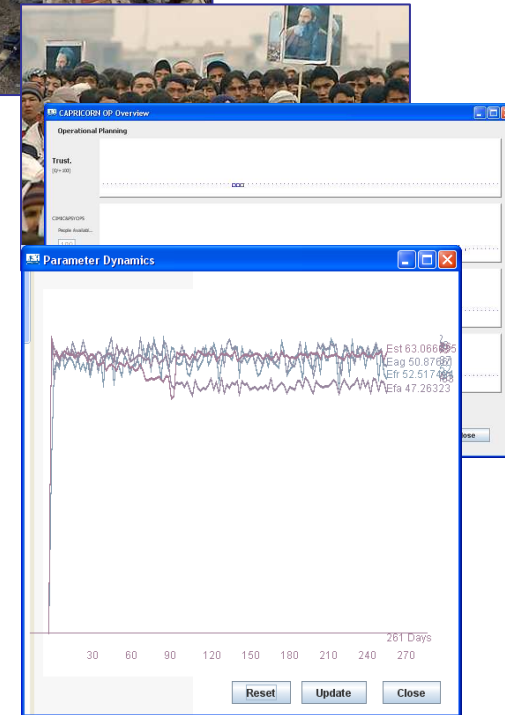
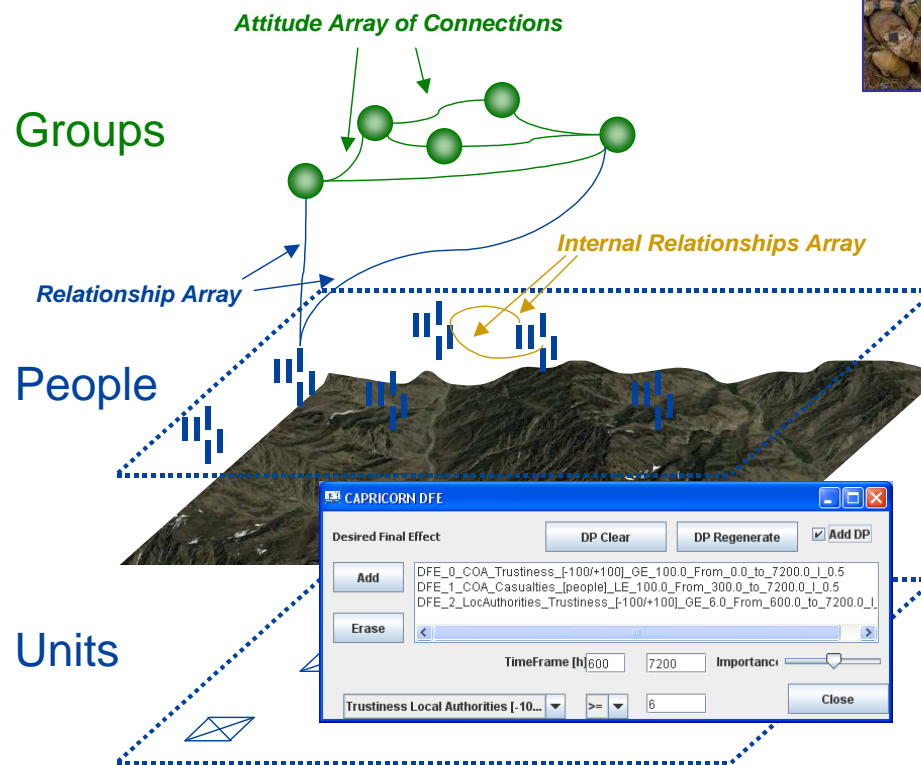
The IA-CGF NCF after creating People, generates the Social Networks and allow to simulate the whole regional behavior of the population





# Multilevel Group Relations

CAPRICORN simulates different Layers

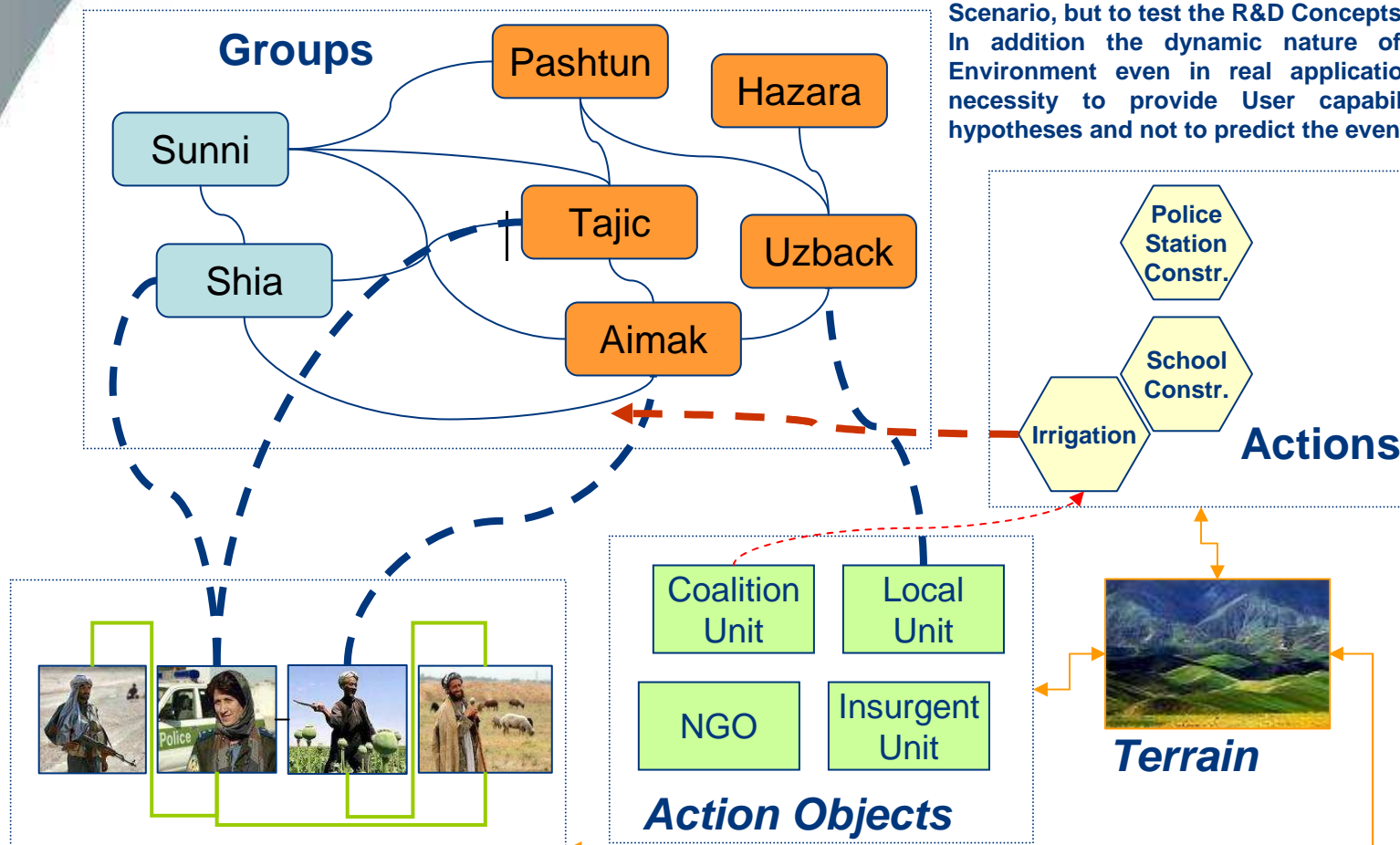






# CAPRICORN Multilevel Objects

VV&A in this case is focused in function VV and in identifying some similar case and in restricting the model to available Knowledge Base  
 This simulator is devoted not to VV a specific Scenario, but to test the R&D Concepts.  
 In addition the dynamic nature of the mission Environment even in real application outline the necessity to provide User capability to check hypotheses and not to predict the events





# Group Relations



**Group Relationships**

Group\_1: COA vs Group\_2: Sunni

Positive: [Slider] Strong: [Slider]

Attitude: [Slider] Influence: [Slider]

Negative: [Slider] Weak: [Slider]

	Very Poor	Poor	Farmer	Worker	Middle Class	Wealthy
Very Poor	85.25	0.0	0.0	0.0	0.0	0.0
Poor	0.0	85.25	6.9779625	0.0	0.0	0.0
Farmer	0.0	6.9779625	85.25	7.877571	0.0	0.0
Worker	0.0	0.0	7.877571	85.25	-8.888997	0.0
Middle Class	0.0	0.0	0.0	-8.88755	85.25	0.0
Wealthy	0.0	0.0	0.0	0.0	0.0	85.25
High Society	0.0	0.0	0.0	0.0	0.0	0.0
Sunni	0.0	0.0	0.0	0.0	0.0	0.0
Shia	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0

Save Update 30.83795 Close

CAPRICORN allows to define relationship among Interest Groups

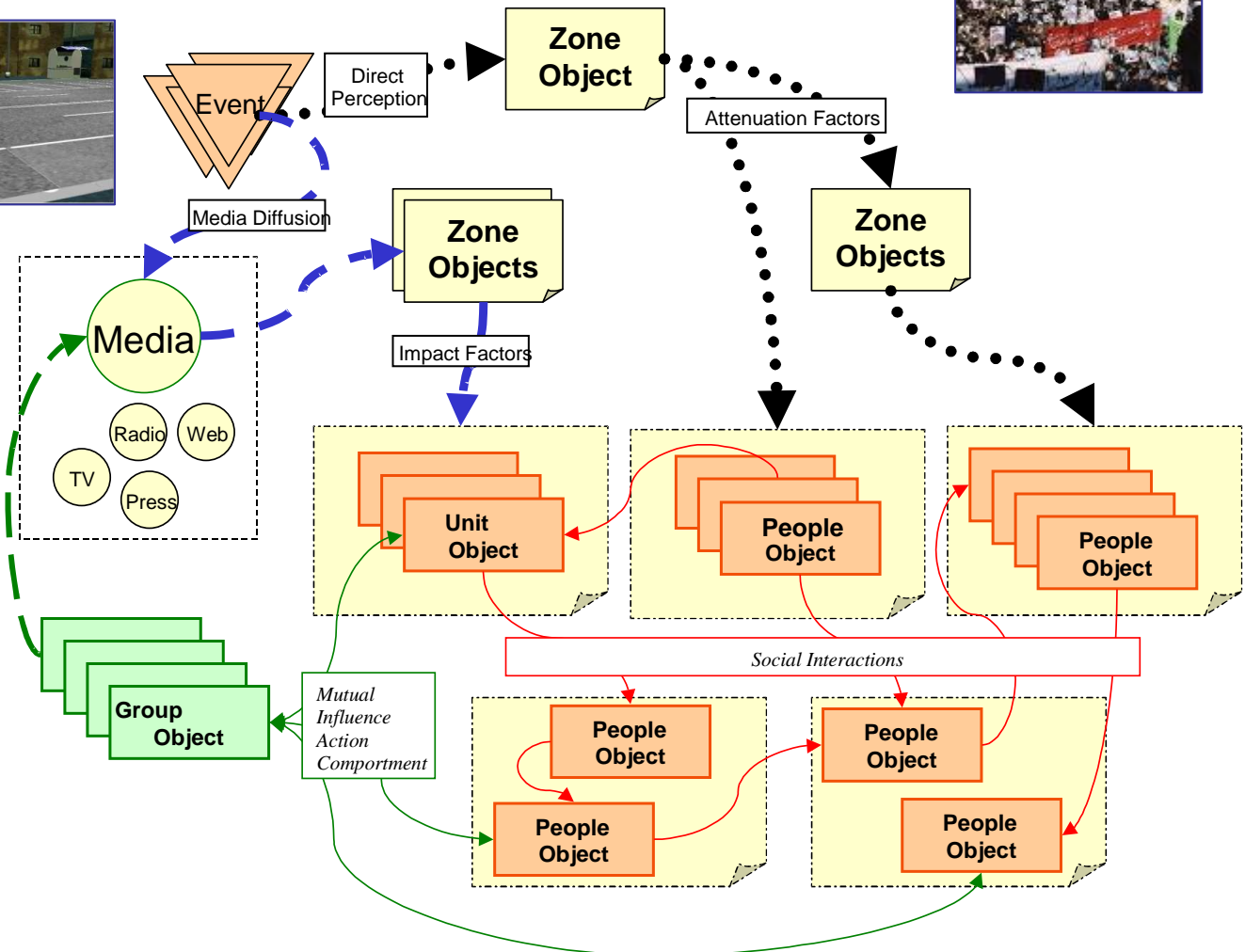


# Interoperable Models



The evolution of the situation requires models such as:

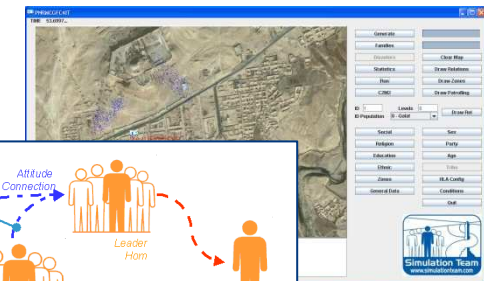
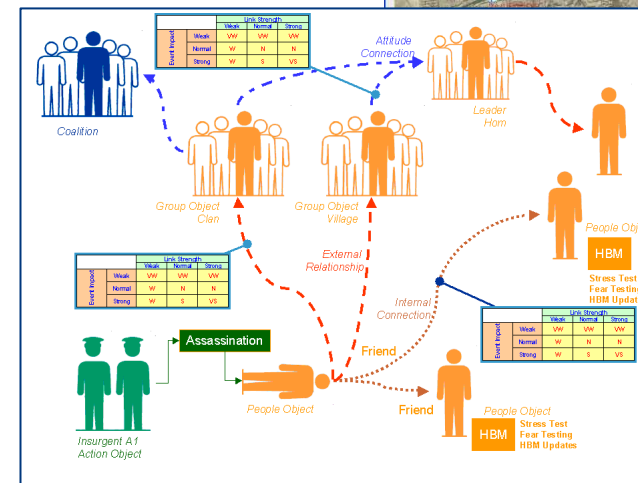
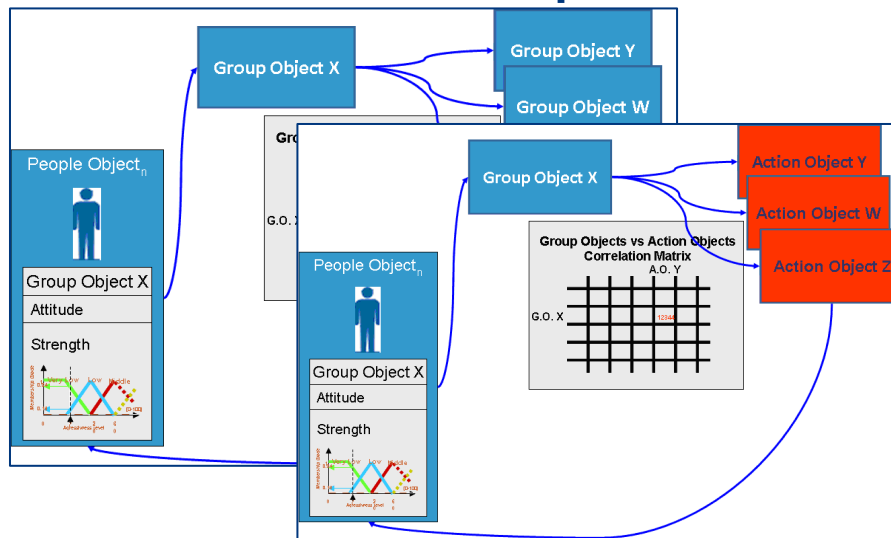
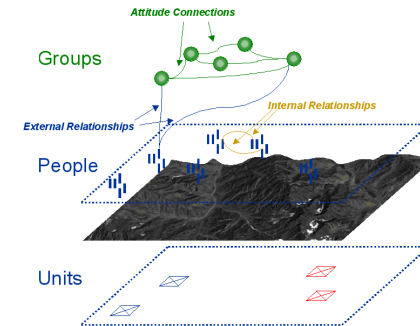
- Civilian Attitude Model: describes changes in population attitude as a result of Host Nation actions and insurgency activities, and perceived good/bad actions.
- Social Network Model: helps to describe civilian response to new factors that interact with civilian behaviors, social structures and specific communication parameters as hierarchy and message contents.
- Economic Model: describes how the economic decision of a Host Nation can affect and impact the attitude and activities of entities.





# Models of CAPRICORN

- CAPRICORN includes different Models:
- IA-CGF Entities and Units
- IA-CGF for People and Groups
- CAPRICORN Multilevel Modeling
- IA- CGF for CIMIC & PSYOP
- Social Network and Human Behavior Modeling
- Diffusion & Perception Models

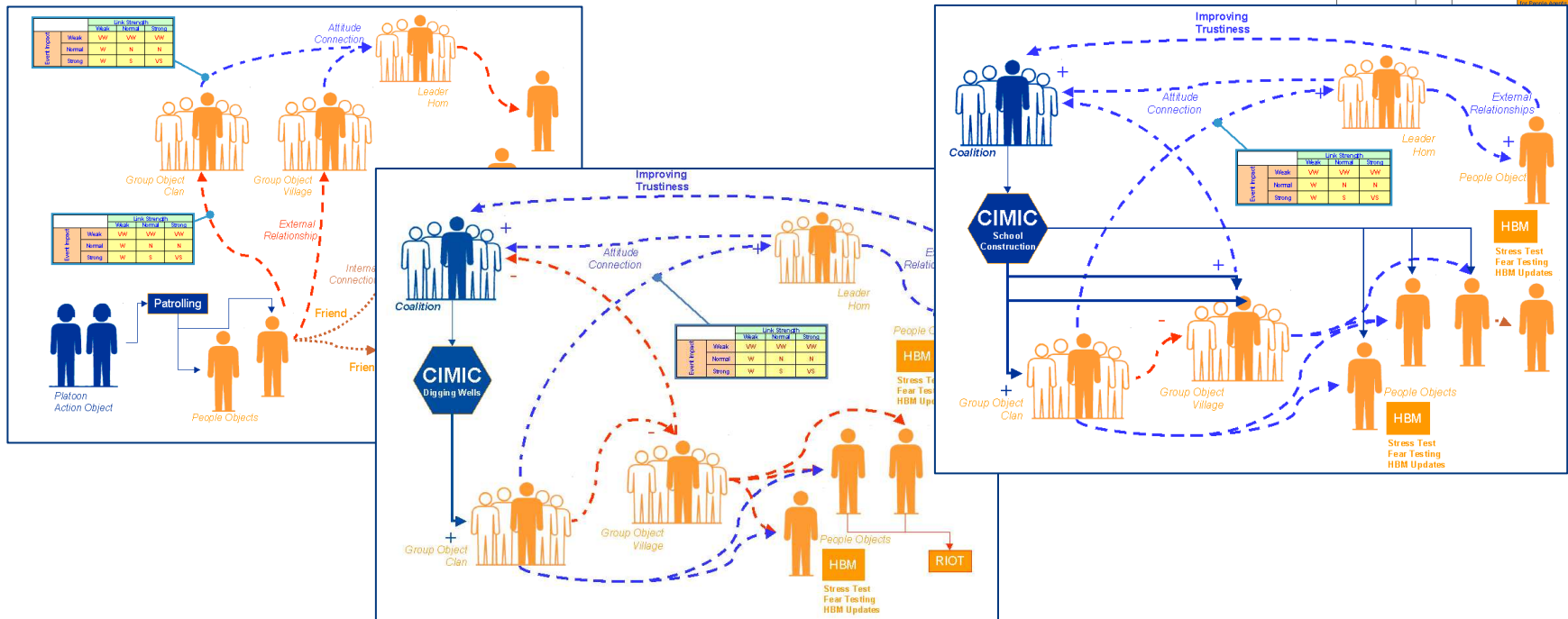
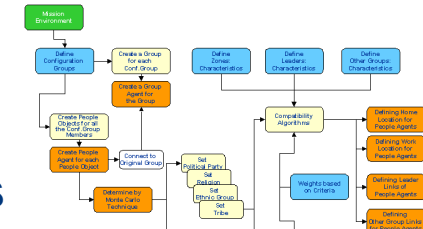




# Techniques and Algorithms within CAPRICORN

In CAPRICORN there are many Algorithms such as:

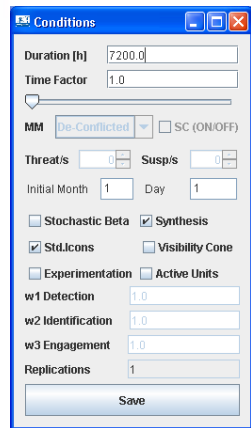
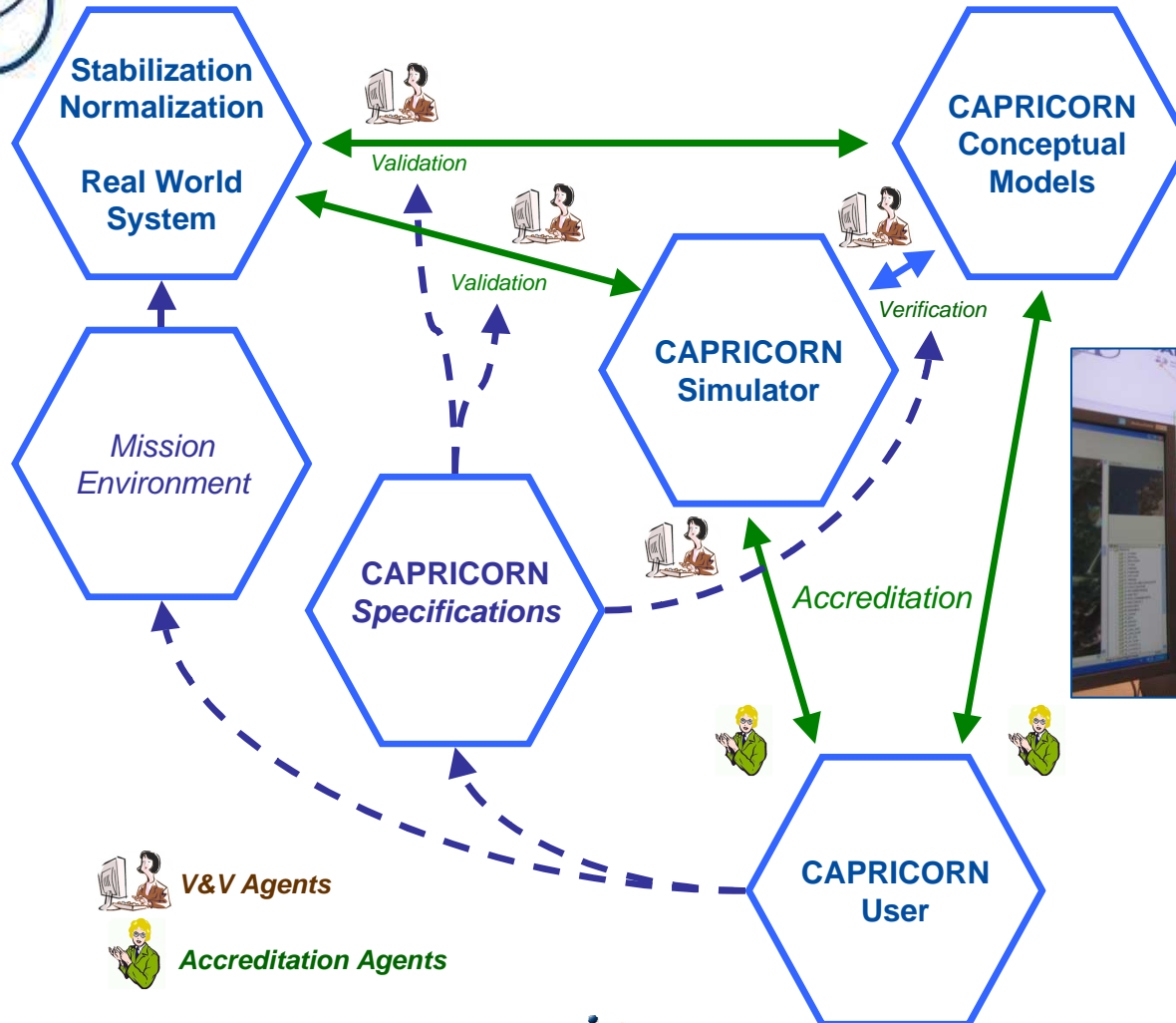
- Population Generation Process
- Social Network Generation & Compatibility Algorithms





# VV&A in CAPRICORN

CAPRICORN  
Verification,  
Validation and  
Accreditation  
General  
Architecture



V&V Agents

Accreditation Agents



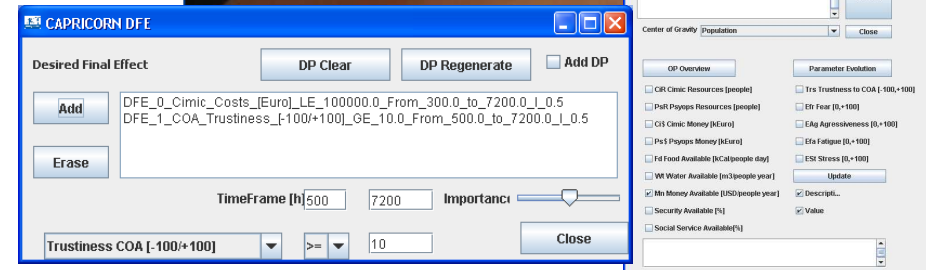
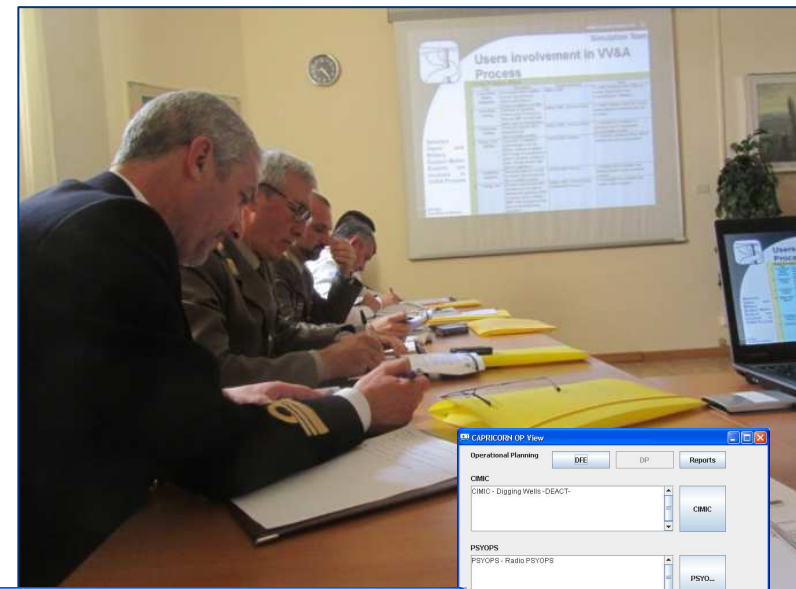


# CAPRICORN Experience

The CAPRICORN Experience was based on running CAPRICORN Demonstrator over a predefined Mission Environment and to test capabilities, functions, use mode.

The Experience was designed by Users and Developers working together; the Project involves Italy and France and the Experience was designed to satisfy the expectations of the two Countries, obviously respecting Project Resource Limitations.

In CAPRICORN national teams were composed by SME and Users: CAPRICORN Champions



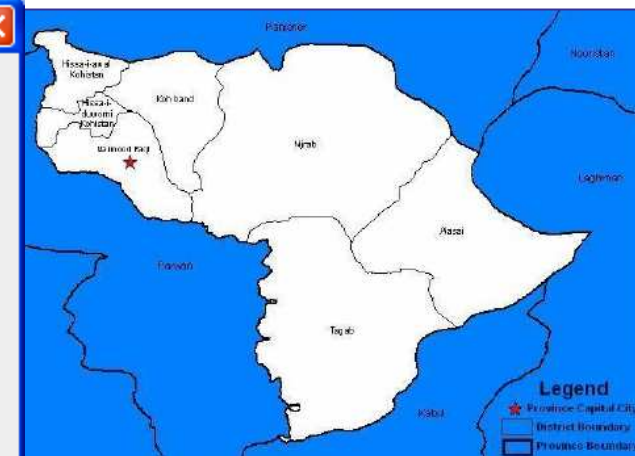


# Experimentation: Kapisa as Region in Afghanistan

Provinces afghanes et zones tribales pakistanaises



Kapisa is the smallest province in Afghanistan, covering 1'908 square kilometers and including seven districts and 358'268 inhabitants used for CAPRICORN Experimentation

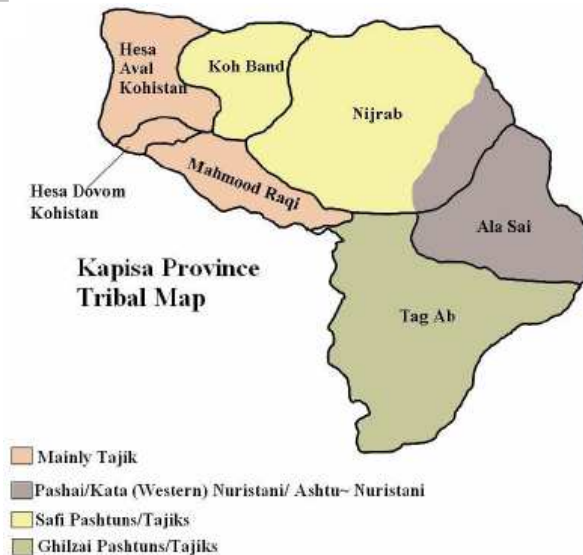






# Weather, Economic and Ethnic Information in Kapisa

- First Economic Sector: Agriculture (crops, fruit, vegetables)
- The sector of small industries (cotton, sugar, tobacco...) is particularly weak: only nine villages are engaged in them
- Three Major Ethnic Groups :
  1. Tajiks 55%
  2. Pashtun 30%
  3. Pashayi's 15%





# CAPRICORN as Stand Alone and Federated Simulation

CAPRICORN operates in different modes:

- Stand Alone
- Federate with Other Simulators



In fact it is necessary to consider

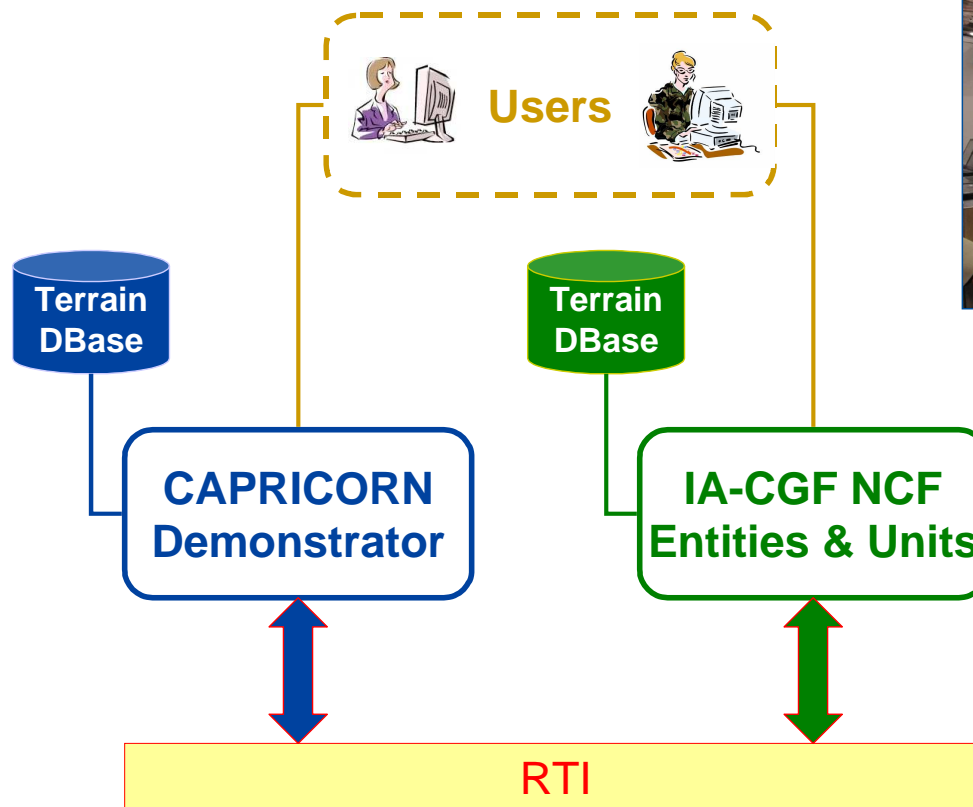
- Activities related to the single CIMIC or PSYOPS operation can't be planned or activated stand alone from other operative functions
- the major actor in CIMIC need to use models completely different from that ones available in major simulation tools that have a big gap in this sector
- Importance to have a quick system to be deployed on site

**CIMIC Models in CAPRICORN could be federate with other LVC (Live, Virtual Constructive) Immersive simulation tools**





# CAPRICORN in HLA: IA-CGF Federation

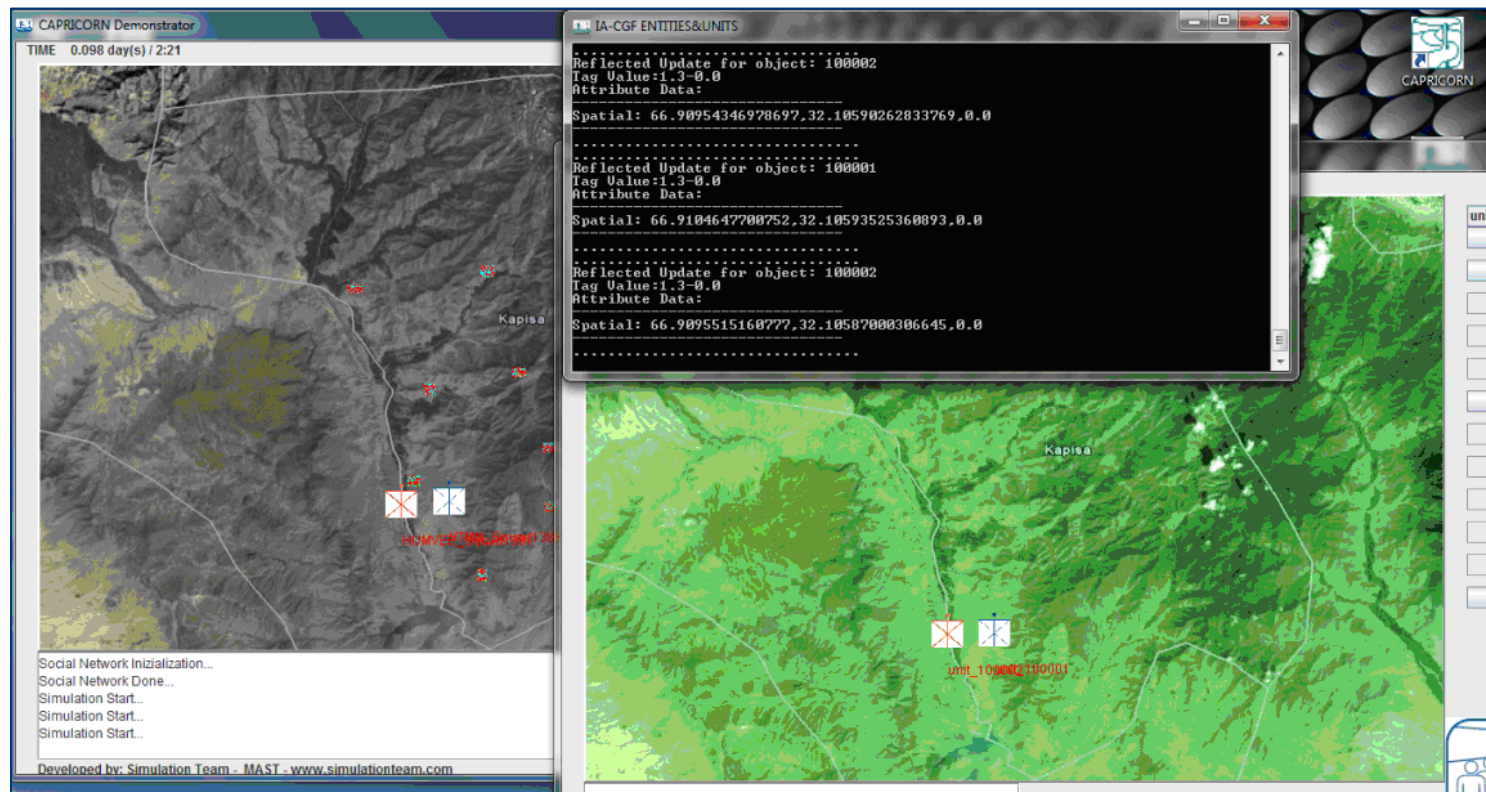


## CAPRICORN Federation Architecture





# CAPRICORN Integration Test



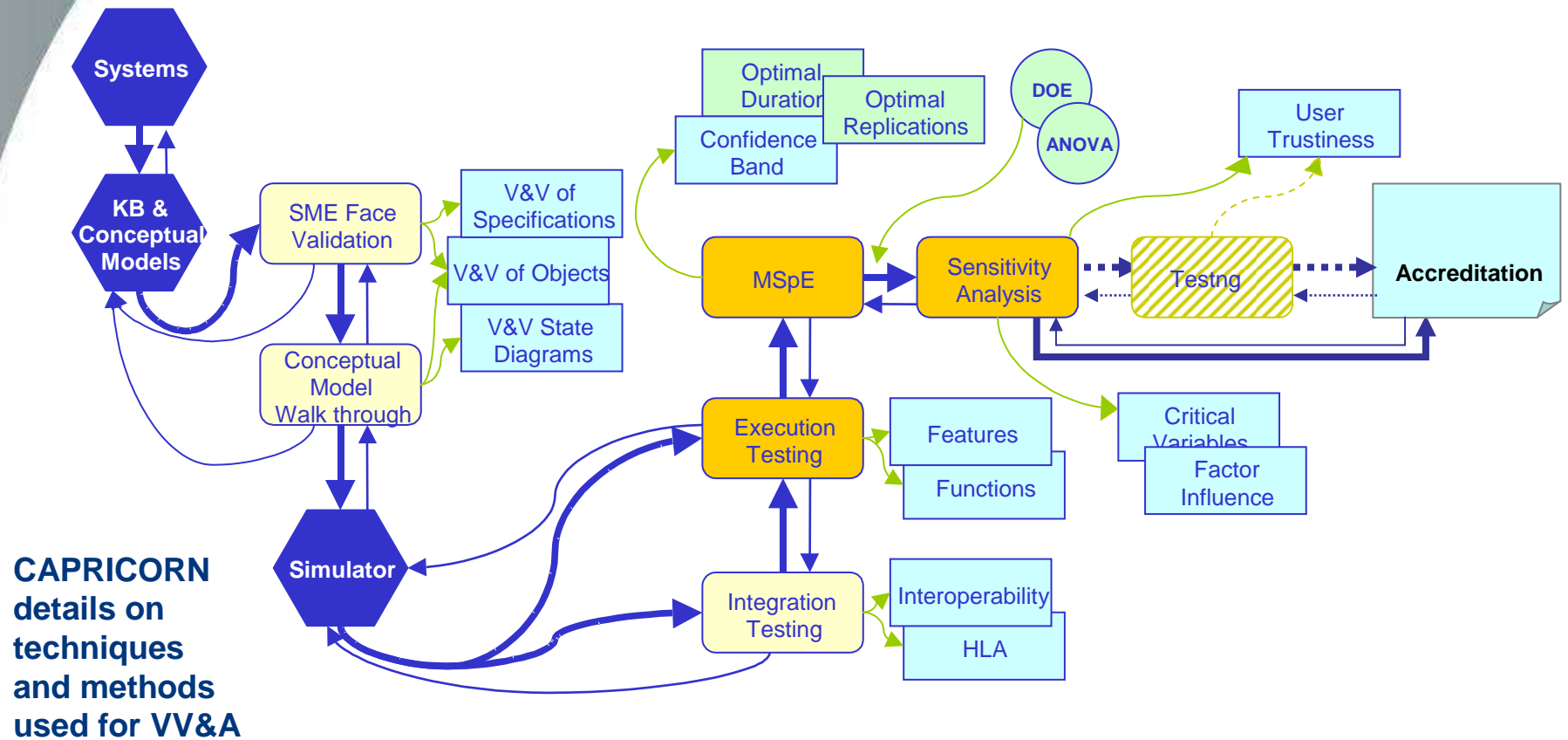
**CAPRICORN  
successfully  
passed  
Integration**

**Test since December 2011 federated with IA-CGF E&U**





# VV&A Process



**CAPRICORN**  
details on  
techniques  
and methods  
used for VV&A



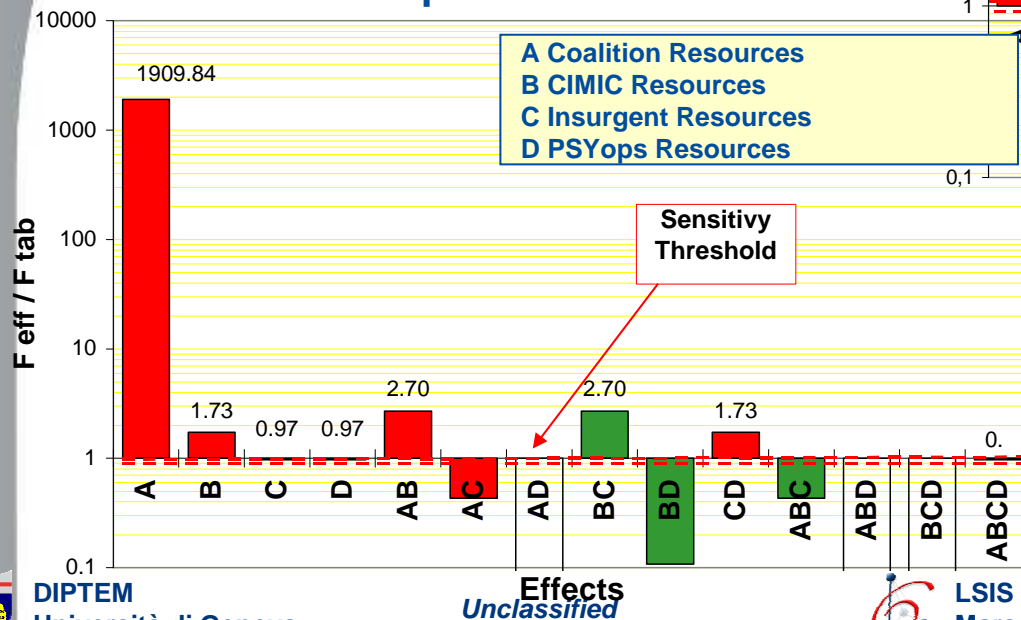


# Sensitivity Analysis

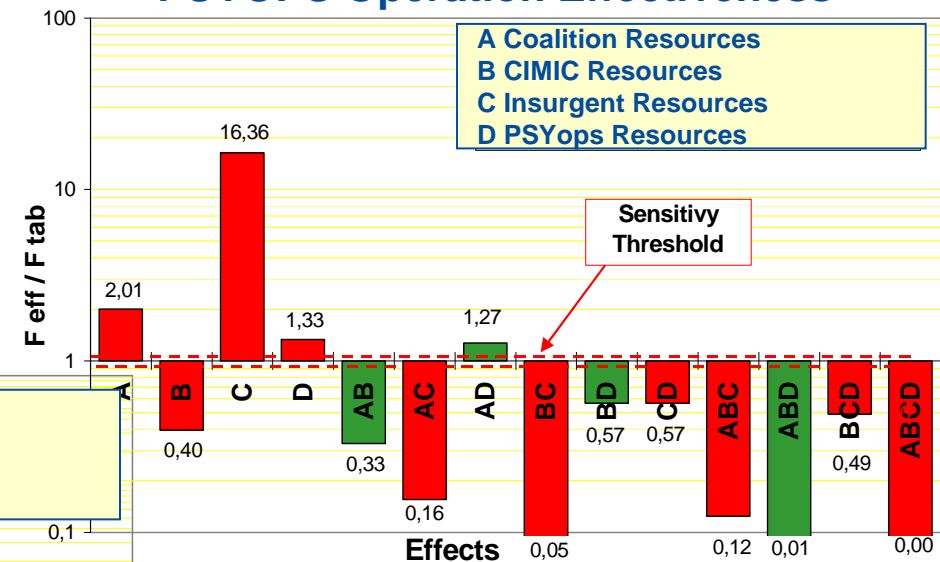
EXAMPLES



## CIMIC Operation Effectiveness



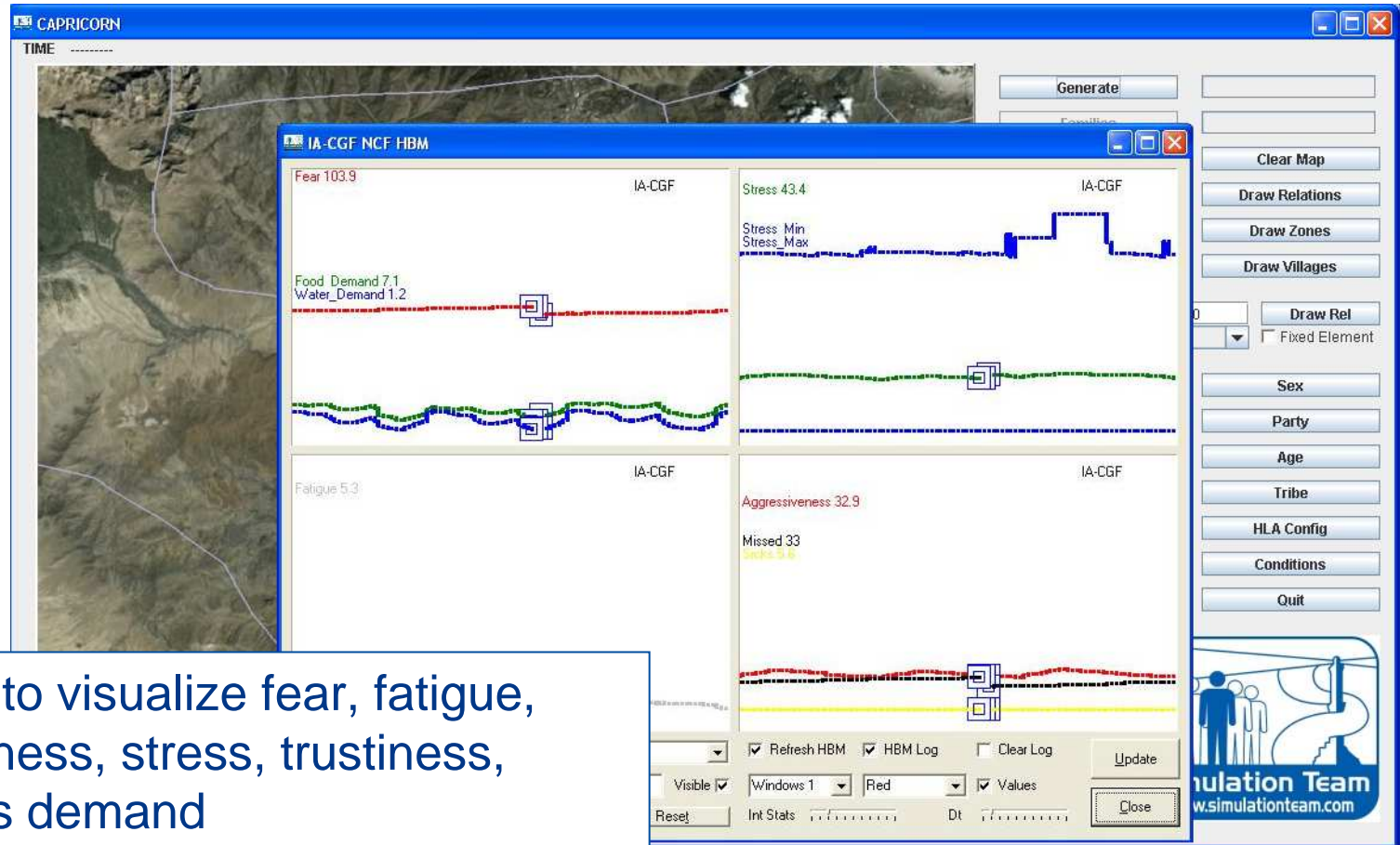
## PSYOPS Operation Effectiveness



The Sensitivity Analysis allows to identify most influent input variables on output and to check consistency in term of influence (direct or inverse)



# Human Behavior Modifier Form



HBM Form to visualize fear, fatigue, aggressiveness, stress, trustiness, basic needs demand



## Conclusions



- CAPRICORN Project faces new challenges: Complex Human Behavior Modeling taking into account psychological and sociological parameters
- CAPRICORN provides demonstration of simulation models of complex activities (CIMIC, PSYOPS and Country Reconstruction).
- CAPRICORN Experimentation Plan was designed and carried out for involving the users to test and validate the CAPRICORN Demonstrator
- CAPRICORN Demonstrator confirmed potential of IA-CGF







# References

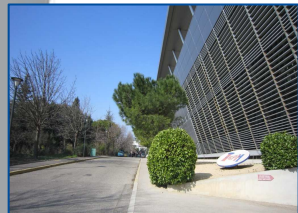


## Simulation Team



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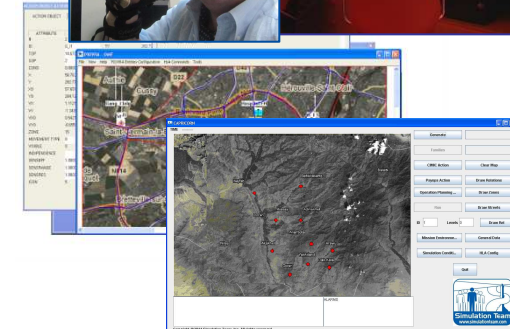
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Marseille

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