Modeling Hybrid Warfare & Emerging Threats: How to address the new Challenges

Paolo Di Bella, DIME PhD Program

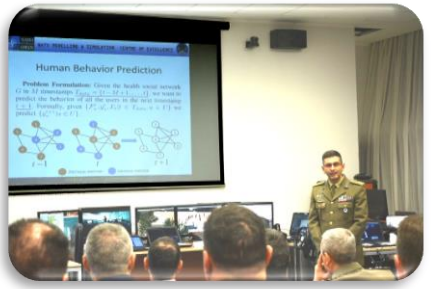
Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

STRATEGOS *and Hybrid Warfare: a New Paradigm*

The Speaker

- PhD Program in Mathematical Modeling and Simulation, DIMS
- formerly Doctrine Standards & Methodology Section Chief at NATO M&S Center of Excellence
- Colonel in Italian Army
- Col. Paolo DI BELLA was appointed as Doctrine Standards & Methodology Section Chief of the NATO Modeling and Simulation Centre of Excellence in ROME in December 2011. He graduated from the Italian Army Signal School as Signal Corps 2nd Lieutenant in 1986, and subsequently was appointed as Platoon Commander and Company Commander. From 2001 to 2002 he participated in Operation Joint Forge inside Multinational Division South East, then from 2003 to 2004 he was assigned to TIPH (Temporary International Presence in Hebron). In 2004 he joined Operation OIF in Iraq, and afterwards he attended the Army Officer Staff Course. In 2005 he joined NATO RAPID Deployable Corps Italy, and participated in Operation ISAF VIII in Kabul in 2006. In 2008 he was appointed as G6 Chief Requirements in NATO Deployable Corps Greece. In 2013 he joined operation ISAF XXII as Chief Information Security Officer. Col. Di Bella has attended the NATO M&S Basic Course, the NATO CAX Certification Course, The Modelling & Simulation Educational Package (Basic and Advanced), SILENI Courses, Liophant M&S Educational Modules. Col. Di Bella, in discharging his duty in the M&s CoE, has been involved in several projects and activities as Human Behavior Modeling, Stanag Ratification, and Lecturer at the NATO MS Basic Course and NATO CAX Course. Col. Di Bella was actively involved in SIMCJOH Project from Italian MoD side and presented Human Behavior Models and Strategic use of Simulation within several International Conferences (e.g. I3M, NATO CAX Forum, WAMS, Spring Sim, etc.); he was key note speaker at I3M2015. After being promoted Colonel, he joined operation Resolute Support in Kabul.
- Col. Di Bella holds the following Academic qualifications:
  - The B.A. in Organizational and Management Science at the University of Viterbo, Italy
  - The Post University Course in International Organizations at the University of Viterbo, Italy
  - The M.A. cum laude in International Relations at the University of Roma Tre
  - The M.A. in History at the University La Sapienza in Roma
- Since 2016 he has been enrolled in PhD Program in Mathematical Modelling and Simulation, DIMS.
- Col Di Bella is a CMSP by NTSA.
- Col. Di Bella enjoys playing war games, tactical boardgames and strategy games in his free time .



Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

Notice/disclaim:

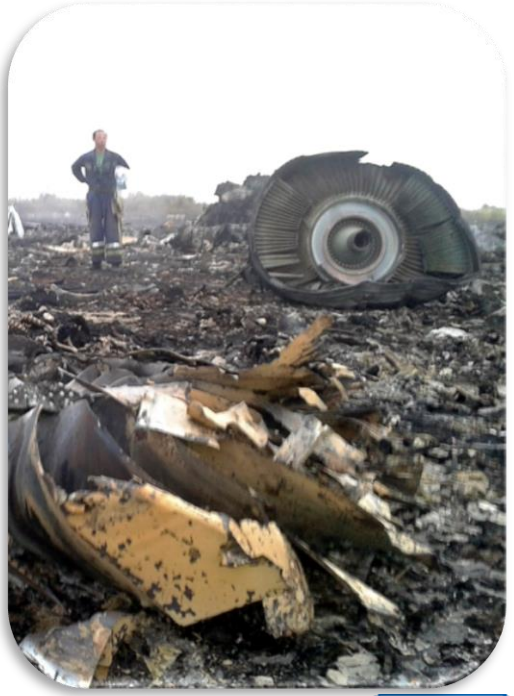
it is necessary to highlight that the content of this presentation the concepts expressed within, does not reflect in any way the official opinions nor of the Italian Government neither of NATO, and the all published materiel - sources, pictures, screenshots, reference books etc. - are unclassified, and so available to public.

Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

AGENDA

- Introduction
- Hybrid Warfare: Environment and Definition
- Simulation Models for Hybrid Warfare (Bruzzone, Cayrci & Di Bella Vs Balaban)
- Time Management in Hybrid Warfare and Military Operations Other Than War (MOOTW)
- Conclusions



Ukraine Crash
MH17, 298 fatalities
17 July 2014

Università di Genova
Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

INTRODUCTION

"Crimea began as a covert military operation, combining ambiguity, disinformation, and the element of surprise at the operational level with more traditional aids such as electronic warfare. The annexation was completed by a traditional military invasion and occupation of the peninsula, using Russia's airborne, naval infantry, and motor rifle brigades. This operation was unique, because Russia's Sevastopol naval base, status of forces arrangements in Crimea, and additional agreements on transit of troops in Ukraine enabled deployments and tactics that would not otherwise have been possible. These operations are, accordingly, not easily reproducible elsewhere".

KENNAN CABLE No. 7 l April 2015

Università di Genova
Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

STRATEGOS *and Hybrid Warfare: a New Paradigm*

INTRODUCTION

"IF AMBIGUITY IS THE REAL CRUX OF THE CURRENT RUSSIA HYBRID THREAT, THEN A HYBRID MINDSET MAY HELP TO DISPLACE THIS UNCERTAINTY BACK ONTO THE RUSSIANS CONCERNING NATO's NEXT"

NATO JOINT WARFARE CENTRE, MAGAZINE

n. 28/2015

"The legal analysis of hybrid threats involves open questions and uncertainties due to the lack of agreed definitions and the state's practice in responding to hybrid threats".

The European Centre of Excellence for Countering Hybrid Threats,

Strategic Analysis, December 2017.

Hybrid CoE

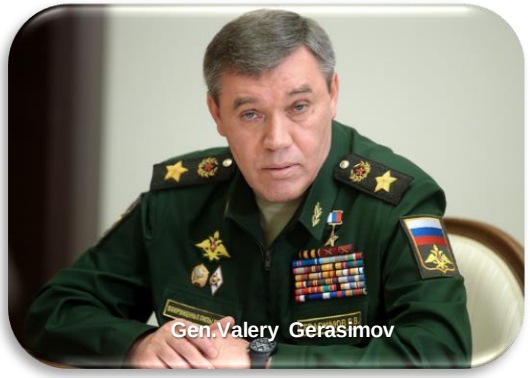
Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

Simulation Team

HYBRID WARFARE: ENVIRONMENT AND DEFINITION

- "The most effective way to perceive, interpret, and plan military operations is in terms of time, rather than space" (Leonhard, 1994-2017).
- Precursors/Prophets of Hybrid Conflict (1999): 2 OF5 China PLA: *Unrestricted Warfare* in the age of globalization - Warfare will no longer defined only by military means. Society it is the battlefield - wars would inevitably encompass attacks on all elements of society without limits.
- Modern military operations cannot be described in purely kinetic effect terms, such as damage and kills (Hartley, 2015). The performance of operations that required more than kinetic effects drove the development of DIME/PMESII models. Similarly, the development of DIME/PMESII models is driving a need to understand and apply social science theories.



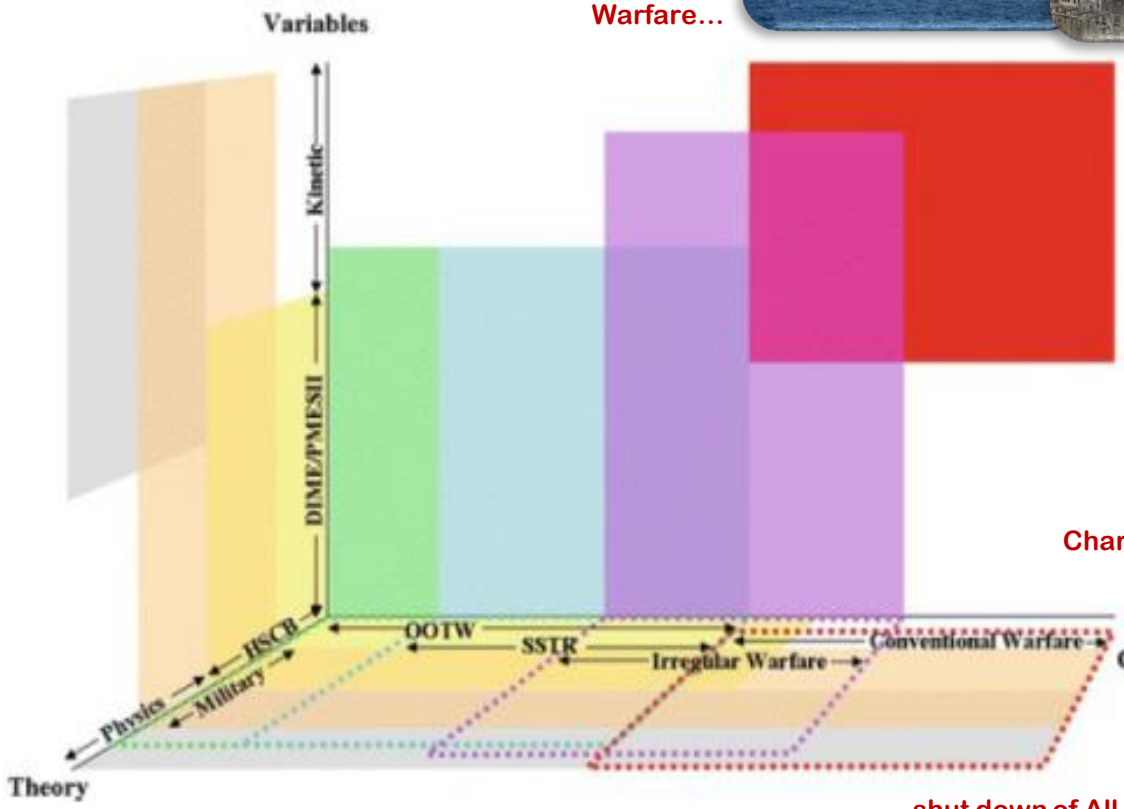
- 2019: V. Gerasimov: "countries bring a blend of political, economic and military power to bear against adversaries", echoing themes he laid out in 2013, likely foreshadowing the …….country's embrace of "hybrid war".

STRATEGOS *and Hybrid Warfare: a New Paradigm*

HYBRID WARFARE: ENVIRONMENT AND DEFINITION

Categorization of Military Operations

Hartley, 2015



Global Nuclear Warfare…

Dresden 3 days Bombing, 1945
~24'000 casualties

Vietnam War 65-74
Casualties
US ~50.000
SVA ~230.000
NVA ~450.000
Civilians ~600.000

Syrian-Kurdish-Islamist War 2013-now
~36 .000 soldiers died

Afghanistan 2001-now…

Charlies Ebdo Attack
May 2015

Estonia, 26 April –May 23, 2007, Cyber Attack
shut down of All Government, Political Parties,
No Parliament Email, No Credit Cards, no ATM, 2 Banks

Università di Genova
Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

PMESEII & DIMEFIL

NATO at Kosovo

- **PMESII**: Political, Military, Economic, Social, Information, and Infrastructure variables that describe the status of a situation (state vector).
- **DIMEFIL**: Diplomatic, Information, Military, Economic, Finance, Intelligence, Legal; refers to the levers of power that a state has to influence the PMESII state.
- Issues:

- 27 subcategories are not independent:
  some of these subcategories are probably correlated and some are probably composites.
- Kinetic models rely on physics,
  which at the gross level is well-understood.
  The non-kinetic parts of PMESII models rely on economics, sociology, psychology, and other very poorly understood sciences.
  (Hartley, 2015)

- **Political**
  - Government
  - Politics
  - Rule of Law
  - Security
- **Military**
  - Conflict
  - Government
  - Other
- **Economic**
  - Agriculture
  - Crime
  - Energy
  - Finance
  - Government
  - Jobs
  - Other
- **Social**
  - Basic Needs
  - Education
  - Health
  - Movement
  - Safety
  - Other
- **Information**
  - General
  - Information Operations
- **Infrastructure**
  - Business
  - Energy
  - Government
  - Transportation
  - Other

Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

STRATEGOS *and Hybrid Warfare: a New Paradigm*

- IOT achieve their political goals, State and non-state actors (groups, even individuals) undertake activities coordinated across the DIMEFIL that challenge the rules of the international order, without triggering the provisions of Self and Mutual Defense (UN Chart).
- This is what has become known as Hybrid Warfare (Cayirci, Bruzzone et all, 2016).

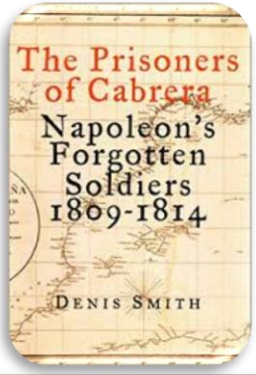
- **Fact Box 1, Hybrid Warfare is:**
  - Highly Integrated (Synchronized)
  - A Combination of Conventional and Unconventional Means
  - Overt and Covert Activities
  - Military, Paramilitary, Irregular and Civilian Actors
  - Directed at Adversary's Vulnerabilities
  - Complicating Decision Making
  - Across the Full DIMEFIL Spectrum
  - Creating Ambiguity and Denial
  - Both State and Non-State Actors

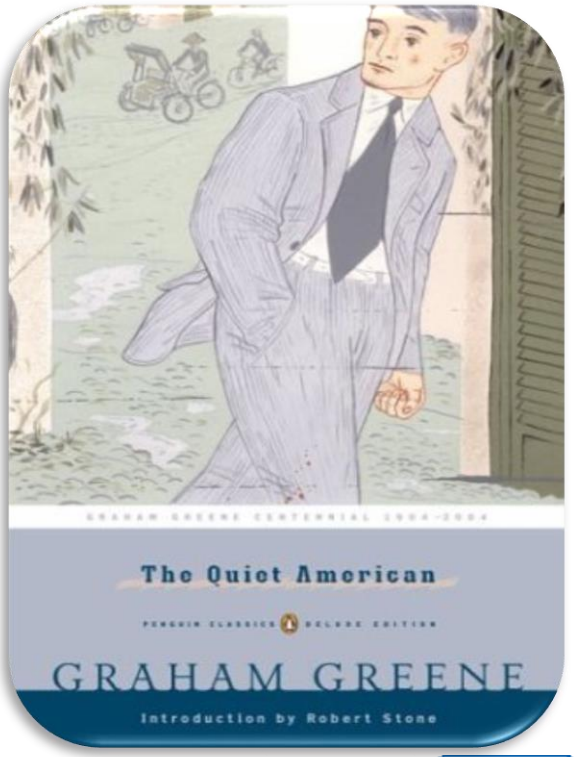
- **Fact Box 2, what is new:**
  - Hihgly Integrated (Synchronized)
  - Combined, Political, Civil and Military Instruments
  - Political Aims achieved through Conventional/Regular, Subversive/Irregular, Criminal Corrupt Actions
  - Increase Vulnerabilities through Globalization emphasized by Technological Advances
  - Fall Short of Direct Military Conflict
  - Complex Propaganda and Misinformation Campaigns
  - Target and Coordinated Political and Economic Pressure
  - Complicating, Delaying and Impeding Timely Decision Making
  - Both State and Non-State Actors
  - Introduce at the Strategic Level
  - No two Hybrid Strategies will be the same

Università di Genova
Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

STRATEGOS *and Hybrid Warfare: a New Paradigm*

- The use of hybrid strategies in conflict are not new: examples of Hybrid Warfare in History:
  - The Peninsular war, 1808-1814 (French Surrender at Bailén , July 1808);
  - Vietnam: then thousand days of war, 1945-1975 (Operation Starlite (1965) vs TET offensive (1968)



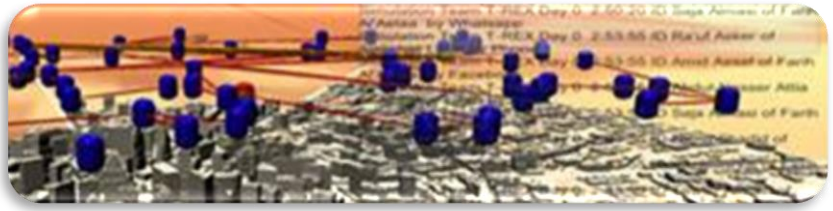


Università di Genova
Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

SIMULATION MODELS FOR HYBRID WARFARE (BRUZZONE, DI BELLA & CAYIRCI vs. BALABAN)

- A MODEL TO DESCRIBE HYBRID CONFLICT ENVIRONMENTS Erdal Cayirci , Agostino Bruzzone(Francesco Longo, Hakan Gunneriusson in Proceedings of the International Defense and Homeland Security Simulation Workshop 2016

- T-REX: JOINT APPROACH TO MODEL HYBRID WARFARE TO SUPPORT MULTIPLE PLAYERS, Agostino Bruzzone, Paolo Di Bella (R.Di Matteo, M.Masse, A.Reverberi, V.Milano), in proceedings of WAMS 2017



- HYBRID CONFLICT MODELING, Mariusz Balaban & Paweł Mielniczek, in Proceedings of the 2018 Winter Simulation Conference.

Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

A MODEL TO DESCRIBE HYBRID CONFLICT ENVIRONMENTS: FINDINGS/FACTS: HYBRID STRATEGY

- A Hybrid Strategy is an offensive strategy
- Two key values related to the community/nation under attack: willingness and threshold
- The willingness is the level of desire and stamina by the targeted community to engage with the offender. It also implies the support by the international community to the defendant.
- When the willingness is over the threshold, the targeted community approves tackling with the offender, even an armed conflict, after which the hybrid environment may become a theatre of operations unless the offender backs off. Of course, after this point, the offenders' homeland may also become a theatre of operations, and hence, the conflict is not a proxy war for the offender anymore.
- Therefore, the offender aims to keep the threshold as high as possible, while managing the willingness as low as possible. Vague environment, denial and all sort of perception management are the main tools for this.

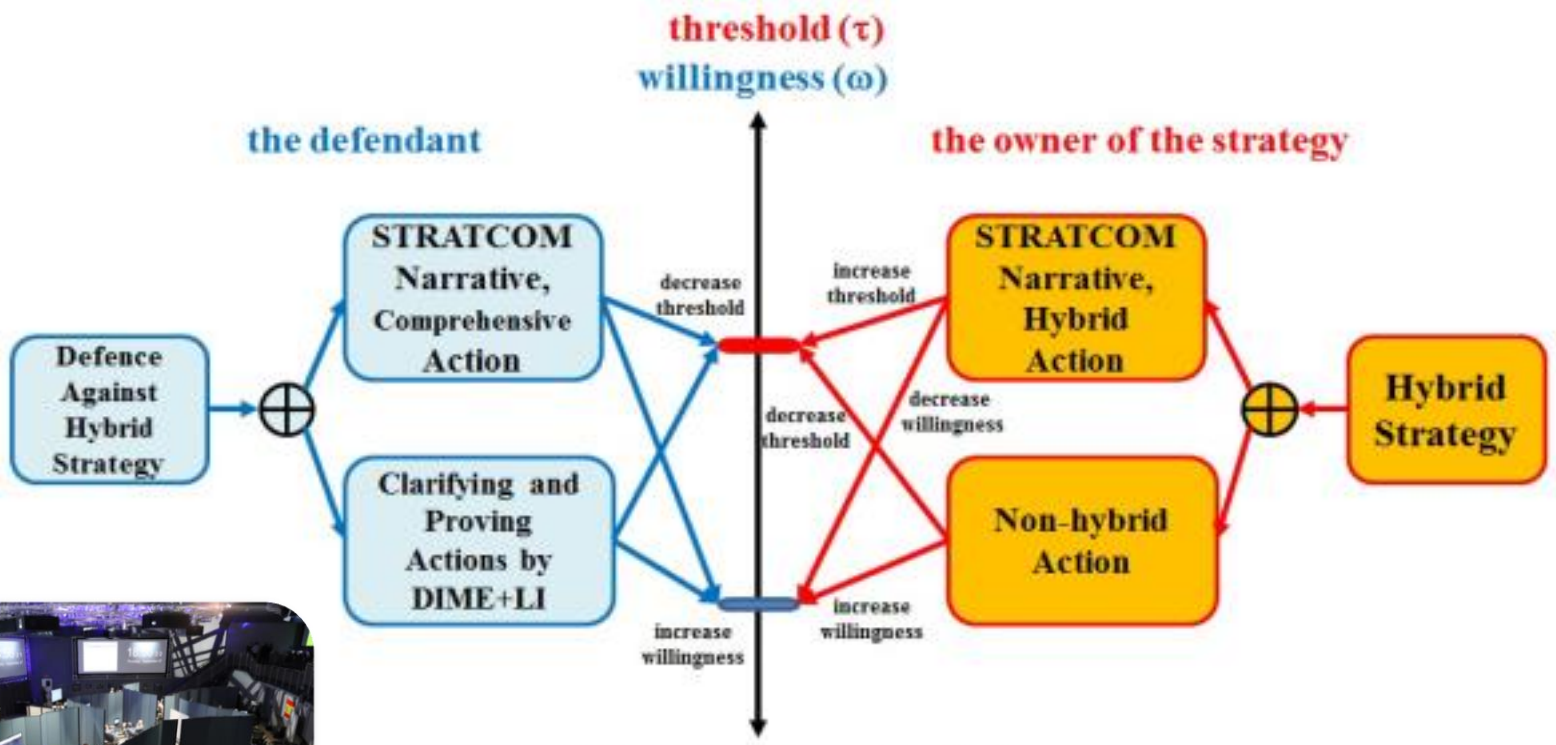
Università di Genova
Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

A MODEL TO DESCRIBE HYBRID CONFLICT ENVIRONMENTS: FINDINGS/FACTS: STRATCOM

- Strategic communications (STRATCOM) is a key both for the defence and the offence in hybrid environments.
- Non hybrid actions increase the willingness and decrease the threshold.
- The defendant aims to decrease the threshold and increase the willingness. The main reason for this is that the capacity of the offender depends on the difference between the threshold and the willingness. For this, the defendant needs to clarify and prove what the reality is.
- All the components of diplomatic, informational, military, economic, law enforcement and intelligence (DIME+LI) domains should be used to achieve that. The aim is to stabilize the community/the nation under hybrid attack and to gain the international and legitimate support for eliminating the hybrid threats. Therefore, comprehensive approach and STRATCOM are the main tools for the defendant.
- In the Figure, the results of the actions are shown as “increase or decrease threshold/willingness”. However, the passive case (i.e., no action is taken) has also a result which is complete opposite of the results shown in the Figure. For example, if the defendant is passive and taking no comprehensive action or does not have a proper STRATCOM narrative, the threshold increases and the willingness decreases.

Università di Genova
Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org
Simulation Team

A MODEL TO DESCRIBE HYBRID CONFLICT ENVIRONMENTS



Università di Genova
Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

STRATEGOS *and Hybrid Warfare: a New Paradigm*

T-REX: MODELING POPULATION & SOCIAL NETWORKS

Threat network simulation for REactive eXperience

The Simulator reproduces the Social Network, Cyber Space and Population and how they react to their perception of the Scenario Evolution.

Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

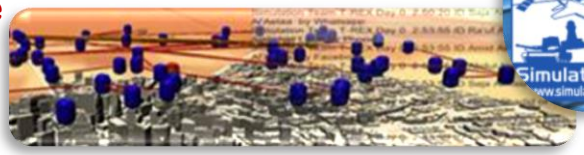
STRATEGOS *and Hybrid Warfare: a New Paradigm*

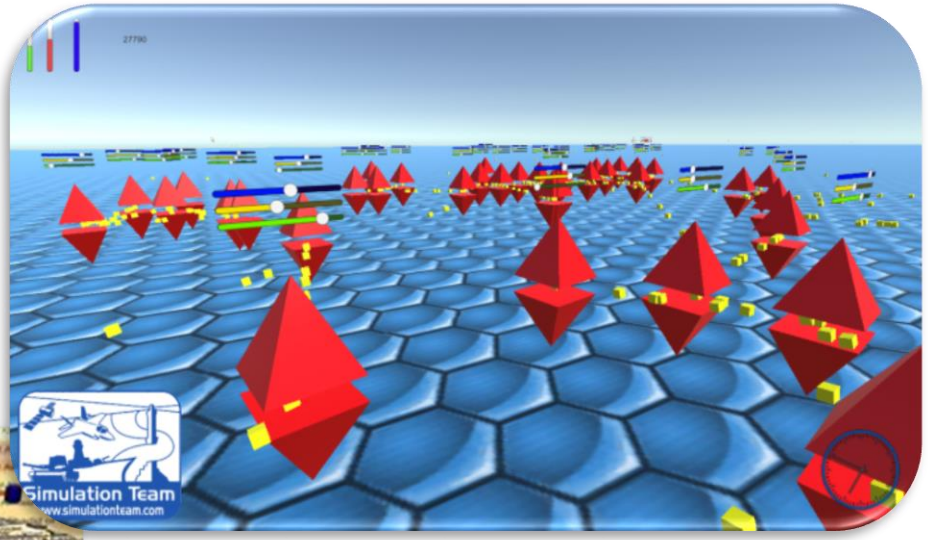
T-REX: CYBER & PHYSICAL THREATS

T-REX and IA-CGF (Intelligent Agents Computer Generated Forces) drive actions on the Cyber Layer where it is mapped the ICT domain and related levels of Confidentiality, Accessibility and Integrity for *each node and link*

Cyber Attack:
- Resources
- Responsiveness
- Efficiency
- Effectiveness
- Virus Dynamism
- Virus Initial Injection
- Virus Infectivity
- Virus Resilience
- Virus Level

Cyber Defense:
- Resources
- Responsiveness
- Efficiency
- Effectiveness
- Anti Virus Diffusion
- Anti Virus Resilience
- Anti Virus Level





Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

HYBRID CONFLICT MODELING

Balaban & Mielniczek

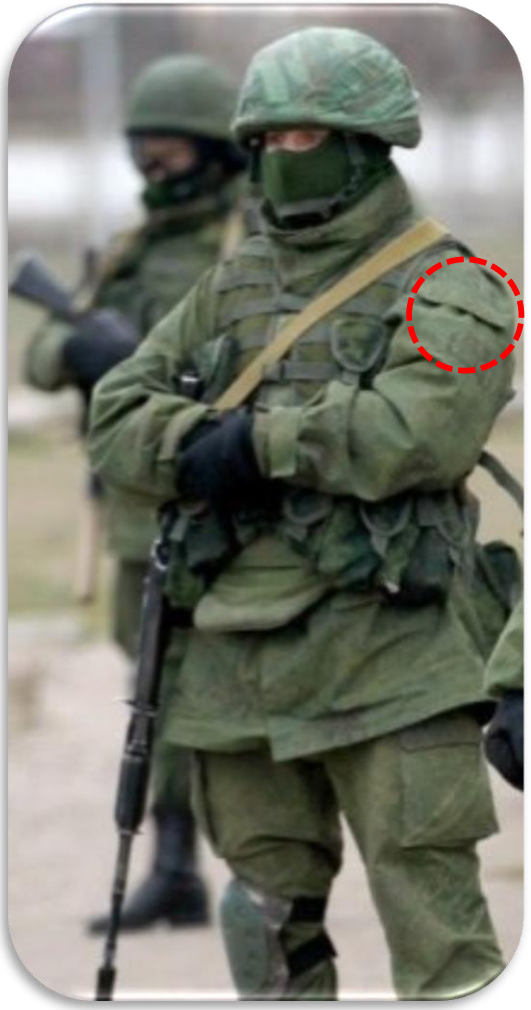
- hybrid warfare is used not only by weak states and none-state entities but also by powerful and capable states
- hybrid warfare reflects a wide range of activities that state and non-state actors undertake in order to gain political, military, economic, social, information, infrastructure, physical environment, and time (PMESII-PT) advantages.
- acts of regular warfare are addressed by regular forces
- threat of use of force is addressed not only by boosting own military capacities, but also by diplomatic means, such as seeking alliances and guarantees
- covert support for insurgents or terrorists is addressed by special forces, special agents and police
- negative propaganda is addressed by national media to create counter-narratives, cyber-security specialists, in case propaganda is disseminated as a result of cyber-attacks, and even courts, in cases propaganda entails attacks on reputation
- cyber-threats may be addressed by cyber-security forces, if they are available, or by cyber-security specialists
- espionage threats are addressed by counter-intelligence
- chemical or biological threats are addressed by special forces, special agents and police experts who eliminate chemical and biological threats or mitigate their effects.

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

HYBRID CONFLICT MODELING

- Hybrid threats, hybrid warfare, hybrid conflict, and hybrid war, are terms often used when describing the ongoing conflicts in the Middle East and Ukraine, but their meanings are not always consistent. U.S. Army defined hybrid threat as diverse and dynamic combination of regular forces, irregular forces, and/or criminal elements all unified to achieve mutually benefitting effects (DA 2010 Thiele 2015) identified hybrid warfare as combining four instruments of power, i.e. diplomatic, informational, military, and economic (DIME).
- Cirimpei (2016) considered PMESII battlespace operational variables to assess country's vulnerabilities to a potential hybrid threat.
- Vaczi (2016) used levels of intensity of threats and intentions of actors involved to distinguish between hybrid threat, hybrid conflict, and hybrid war.
- Pawlak (2015) identified transition from a hybrid conflict to a hybrid war as a situation where hybrid threat evolves and intensifies to overt use of conventional force.
- Following Image shows dependencies between proposed definitions of several key terms central to this work.

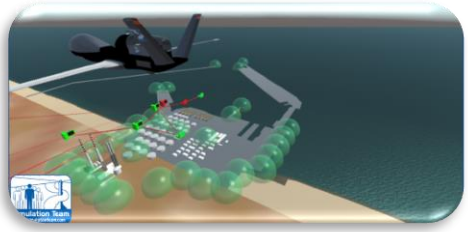
Little Green Men **without insignia operating in Ukraine**



Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

STRATEGOS *and Hybrid Warfare: a New Paradigm*



Hybrid War

Intensifies into

Hybrid Conflict

controls objective and intensity of

accumulates into

Hybrid Threat

uses

Hybrid Warfare

circumvents & Ignores

War & Humanitarian Laws

controls objective and intensity of

Dependencies among relevant terms

Balaban & Mielniczek (2018)

Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

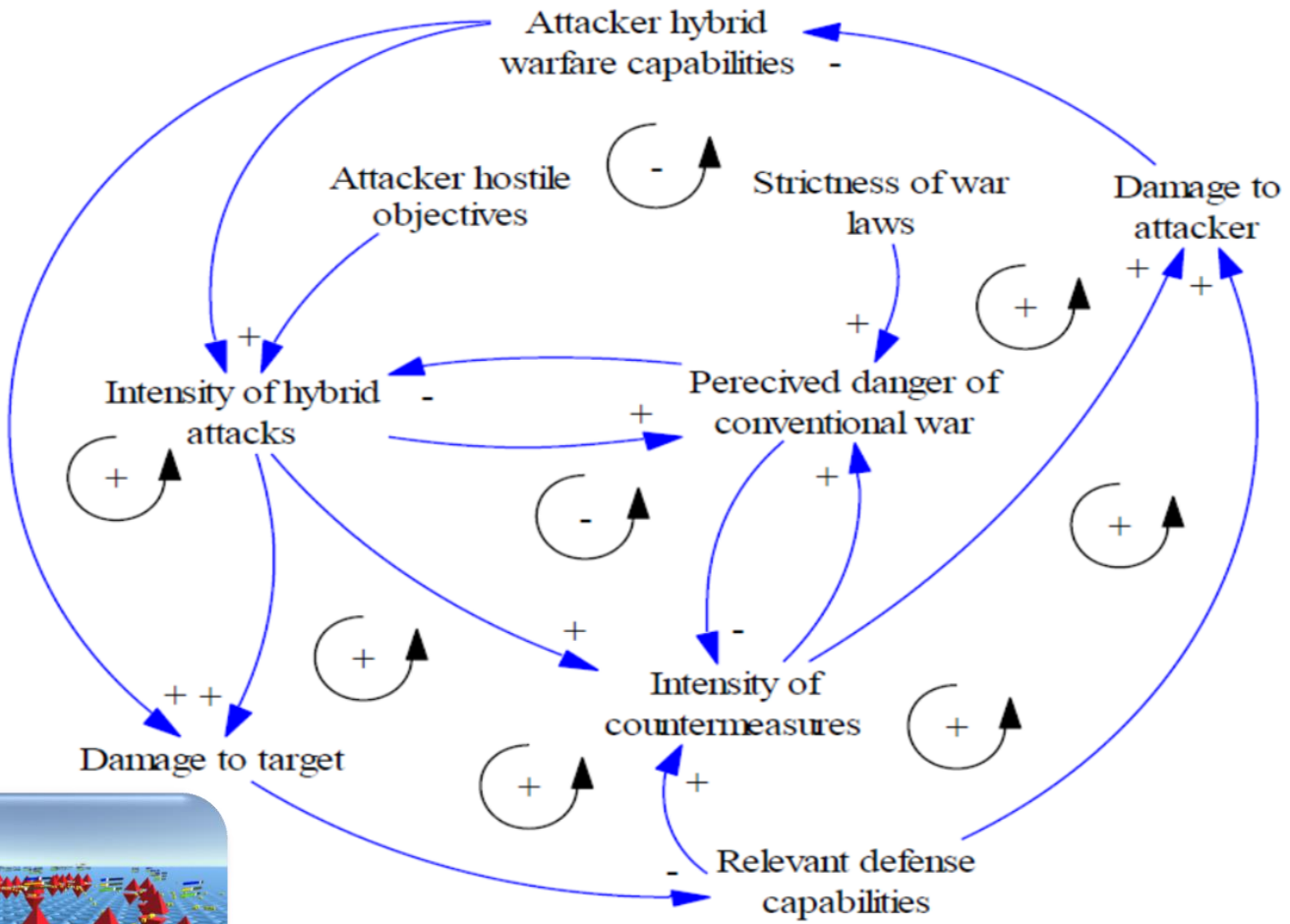
HYBRID CONFLICT MODELING

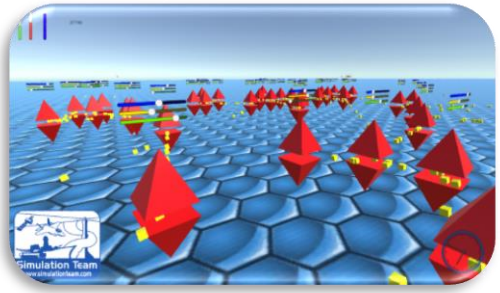
- The proposed conceptual Model it is based on the fact that Hybrid Conflict include an attacker, and its target; following figure shows a proposed theoretical Causal Loop Diagram of Hybrid Conflict.
- The intensity of hybrid attacks is controlled by attacker hostile objectives and under those objectives increases with the expanded attacker hybrid warfare capabilities. The increase of intensity of hybrid attacks effects in a higher damage to target and increases intensity of countermeasures.
- The strictness of war laws defines the line between the HC and hybrid war.
- It positively affects a perceived danger of conventional war. The perceived danger of conventional war increases with a growing intensity of hybrid attacks and with a growing intensity of countermeasures, but additionally generates feedback links decreasing both of its causal factors.
- The damage to target has a negative effect on its relevant defense capabilities, which has a positive relation with intensity of countermeasures. Both, intensity of countermeasures and relevant defense capabilities have positive relation with damage to attacker. Finally, the higher the damage to attacker the lower the attacker hybrid warfare capabilities, which has a positive relation with damage to target.
- high dynamic complexity of the system.


Kobane after the battle

Università di Genova
Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

STRATEGOS *and Hybrid Warfare: a New Paradigm*





Concept of Hybrid Conflict

Balaban & Mielniczek (2018)

Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

TIME MANAGEMENT IN HYBRID WARFARE AND MILITARY OPERATIONS OTHER THAN WAR

- *"Throughout the ups and downs of this conflict, it's become evident that the United States is not going to defeat the Taliban insurgency, even though it can prevent a Taliban victory" (The Washington Post, 1st September 2018).*
- That traditional military history has dealt with the subject of warfare just from a spatial perspective, a three-dimensional box shaped by length, width, height. But there is a fourth dimension in warfare, time
- Napoleon, he was always busy at mastering the time while denying such scarce resource to his adversaries on the battlefields. "The loss of time is irreparable, in war...Space you can recover…time never", Napoleon once asserted.
- if the duration of a war/hybrid confrontation is managed by the top political level of a country, on the other hand the military influence heavily the length, which is then a function as well of how that war is carried out by the troops

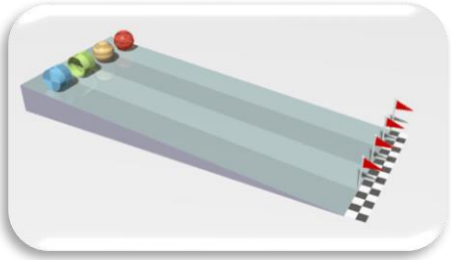
Università di Genova
Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

TIME ACCELERATION IN OPERATIONS

TIME – PHYSICAL DIMENSION & SOCIAL PERCEPTION

Poland was conquered in 20 days, 1939

Acceleration (t^2) is the clock of the crisis development



Peace Time: Planning and exercising

CRISES: THREAT DETECTED

Crisis Action Planning Group

Deployment

ENGAGEMENT

t t^2 t^2 t^2

Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

TIME DECELERATION IN OPERATIONS

Yom Kippur War, 20 days
from October 6 to 25, 1975

Area Normalization is still going since 44 years

TIME – PHYSICAL DIMENSION & SOCIAL PERCEPTION

Deceleration (t^{-2}) until the nullification of (social) time dimension drives the clock of an almost endless commitment

Post Engagement: ○ Low Intensity Conflict (LIC) ○ Counter Insurgency ○ Peace building ○ Country Institution Building ○ Economic development ○ Free elections --- All supported by an International Security Force and Foreign Aids	Up and down of the military counter insurgency operations	1. The conflict drag itself on 2. END STATE not in sight BUT Foreign Policy dictate & LIC is made economically sustainable over time	DECOMMISSIONING (YYYY ?)
	t^{-2}	t^{-2}	t (...?)

Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

STRATEGOS *and Hybrid Warfare: a New Paradigm*

CONCLUSIONS

- Hybrid is not the New WAR; what is new is brought by globalization paired with the transition to the information age and rising geopolitical tensions, which have put new emphasis on hybrid hostilities that manifest themselves in a contemporary way.
- Hybrid Warfare is economically sustainable and diplomatic feasible.
- DIMEFIL-PMESII comprehension is necessary to understand Hybrid Warfare
- Hybrid Warfare is to avoid the direct military conflict, the models of the threshold, as proposed by Caiyrci, Bruzzone, Di Bella et all, remains critical to comprehend Hybrid Warfare and its unforeseen escalation into a regular armed conflict- its dynamicity and flexibility is able to capture the evanescent, blurring line between Hybrid Warfare and Conventional Warfare.
- Multi Layers models are fundamental to evaluate Strategies and Support Decisions
- Strategic Engineering of Conflicts/MOOTW, by comprehension of the Hybrid Dimension and the Time management

China, Vietnam and Philippines tension on Oil Resources over the South China Sea

Università di Genova

Col.Paolo DI Bella, DIMS PhD Program, Liophant Simulation
paolo.dibella@liophant.org

Bibliography/References

- Balaban M., Mielniczek P., Hybrid Conflict Modelling, Proceedings of the 2018 Winter Simulation Conf.
- Bruzzone A.G., Massei M., Longo F., Cayirci E., di Bella P., Maglione G.L., Di Matteo R. (2016) “Simulation Models for Hybrid Warfare and Population Simulation”, Proc. of NATO Symposium on Ready for the Predictable, Prepared for the Unexpected, M&S for Collective Defence in Hybrid Environments and Hybrid Conflicts, Bucharest, Romania, October 17-21
- Bruzzone, A. G., Massei, M., Bella, P. D., Giorgi, M., & Cardelli, M. “Male Nostrum: Modeling within a synthetic environment the complex reality of mass migration”, in proceedings of the Agent-Directed Simulation Symposium, SCS, April 2017.
- Bruzzone A.G., Massei M., Longo F., Cayirci E., di Bella P., Maglione G.L., Di Matteo R. (2016) “Simulation Models for Hybrid Warfare and Population Simulation”, Proc. of NATO Symposium on Ready for the Predictable, Prepared for the Unexpected, M&S for Collective Defence in Hybrid Environments and Hybrid Conflicts, Bucharest, October 17-21
- Bruzzone, A. Di Bella P. Di Mattero R. Massei M. Reverberi A. Milano V. “Joint Approach to model Hybrid Warfare to support multiple players”, in proceedings of WAMS 2017
- Cayirci, E., Bruzzone, A., Longo, F. & Gunneriusson, H. 2016, "A model to describe hybrid conflict environments", 6th International Defense and Homeland Security Simulation Workshop, DHSS 2016.
- Di Bella (2015) “Present and Futures Scenarios and Challenges for M&S terms of Human Behavior Modeling”, I3M Keynote Speech, Bergeggi, IT
- Hartley, D. “Conflict and Complexity-Understanding Complex Systems: DIME and PMSEII models”, Springer 2015.
- Liang, Q. , Xiangsui, w. “Unrestricted Warfare”, 1999.
- Leonhard, R. (1994), Fighting by minutes: Time and the Art of War, Praeger
- Murray, W. Mansoor R,(eds) Hybrid Warfare: Fighting complex opponents from the Ancient World to the present (2012) Cambridge University Press.
- Wittes B., Blum, G. “The Future of Violence: Robots and Germs, Hackers and Drones-Confronting A New Age of Threat” (2015)

Web

http://www.itim.unige.it/cs/strategos/index.html

https://www.nato.int/

https://www.eda.europa.eu/

https://www.mscoe.org/

https://ccdcoe.org/

https://enseccoe.org/en

https://www.stratcomcoe.org/

https://www.hybridcoe.fi/

https://www.nytimes.com/2019/03/02/world/europe/russia-hybrid-war-gerasimov.html