

Description of the International PhD Program in Strategic Engineering



Strategic Engineering International PhD Program

Aim

The aim is to create a New International PhD Program involving top quality Universities focused on the new discipline called **Strategic Engineering** and to develop strong Synergies with Leading Institutions, Agencies and Excellence Centers (e.g. NATO M&S Center of Excellence, Water Academy) that are interested to benefits of the related Researches, Developments, Capabilities, Skills and People.

Premise

Strategic Engineering is a new emerging Discipline that focuses on developing a combined use of Modeling, Simulation (M&S), Data Analytics and Artificial Intelligence (AI) in closed loop with Big Data to support Decision Makers in a wide spectrum of Applications.

The idea is pretty well summarized by a Plato's quote about what is a **STRATEGOS** (formerly a General or Admiral of ancient Greece City States) as a "Person that owns the Art to Know better than others what is Happening or is Likely to Happen". In this sense, **Strategic Engineering** aims to develop new capabilities by using cutting edge technologies to create new Solutions able to guarantee a Strategic Advantage in Decision Making.

In effects, **Strategic Engineering** strongly relies on the concept to create new scientists and engineers able to work side by side with Decision Makers and Commanders to design, develop, use and finalize new Solutions to get a competitive advantage. It is evident that **Strategic Engineering** is strongly trans-disciplinary and combines expertise in Engineering, AI, ICT (Information & Communications Technology), Intelligence, Defense, Economics, Geo Politics, etc. The idea was presented originally in MIT (Massachusetts Institute of Technology) and it is currently the core of International Master Programs (e.g. **STRATEGOS**, Engineering Technology for Strategy and Security, Master of Science in Defense and Security at Genoa University Italy) as well as a very interesting subject for many Industries (e.g. Leonardo, Thales, MBDA, Ansaldo, Hitachi), Consulting Firms (e.g. Accenture, RINA, Bearing Point) as well as International Centers of Excellence (e.g. NATO M&S COE, Water Academy).

Description of the International PhD Program in Strategic Engineering



Strategic Engineering PhD Extending MSc **STRATEGOS**

In particular this initiative results as a natural extension of **STRATEGOS** initiative, the first Master of Science in **Strategic Engineering** in Italy and among first ones worldwide organized by Genoa University; **STRATEGOS**, MSc in Engineering Technology for Strategy and Security, is a 2 year Program (Laurea Magistrale) Engineering for Defense and Security that is currently going to complete the 2nd year (20 International Students 1st Edition and 40 International Students 2nd Edition, continue along the covid-19 crisis by adopting web technologies, using virtual labs and innovative simulation solutions). **STRATEGOS** is already engaging major Companies and excellence Centers, therefore this existing and successful initiative is base of qualified young engineers and scientists that could provide a fundamental support to find talents for this PhD in synergy with Partners & Institutions.

The current evolution and enabling technologies are Generating a gargantuan quantity of data sources and, as consequence, producing Big Data, therefore these data are pretty far away from being useful information and require use of advanced Data Analytics and AI to extract valuable information to develop a clear understanding of past and current situation for a posteriori analysis. Therefore, it is fundamental to extend these capabilities by using the extracted information and fused data to feed models and to run simulations able to evaluate the impacts of critical decisions as well as to evaluate the risks and opportunities related to different COEs (Courses of Actions). By this approach it turns possible to combine a posteriori with a priori analysis and to close the loop by applying Machine Learning to dynamically retune models and algorithms based on the effective results of our decisions measured on the field.

Objective

The Creation of the **Strategic Engineering International PhD Program** will finalize a framework agreement among multiple Universities (e.g. Genoa University in Italy, Universidad de la Rioja in Spain; École des Mines d'Alès in France, Obuda University in Hungary, , Università della Svizzera Italiana in Swizerland, University of Defence in Czech Rep., Wroclaw University of Technology in Poland Old Dominion University in USA, KTH Royal Institute of Technology in Stockholm Sweden) with joint Experts collaborating side by side for Selection, Supervision, Intermediate Review and Final Defense.

The **Strategic Engineering PhD Program** develop Researches and Developments applied to Complex Systems as the capability to analyze Scenarios and to identify Solutions to support Strategic Decisions.

The **Strategic Engineering PhD Student** shall acquire expertise in these fields and develop their Project Work to be highly qualified in supporting Strategic Decisions and Commanders in challenging problems by using cutting edge technologies in combination.

Description of the International PhD Program in Strategic Engineering



Leading Entity & Organization

Genoa University (Università degli Studi di Genova), by Polytechnic School in cooperation with Schools of Economy, Medicine, International & Law Affairs will serve as leading Entity based on Primus inter Pares concept. The PhD Program is based on strong cooperation with International Universities, International Excellence Centers (e.g. MSCOE) as well as Patronage by major Companies (e.g. Leonardo, MBDA, Thales, etc) and High Tech SME (Small Medium Enterprises)

The **Strategic Engineering PhD Program** involve following Committees:

Project Steering Committee (PSC): PSC Members

- Agostino Bruzzone, Genoa University, Italy;
- Anna Sciomachen, Genoa University, Italy;
- Elvezia Maria Cepolina, Genoa University, Italy;
- Emilio Jiménez Macías, Universidad de la Rioja, Spain;
- Julio Blanco Fernandez, Universidad de la Rioja, Spain;
- Javier Tardáguila, Universidad de la Rioja, Spain;
- Horvath Laszlo, Óbuda University, Hungary;
- Kovács Levente, Óbuda University, Hungary;
- József K. Tar, Óbuda University, Hungary;
- Nicolas Daclin, IMT Ecole des Mines de Ales, France;
- Francois Trouset, IMT Ecole des Mines de Ales, France;
- Gregory Zacharewicz, IMT Ecole des Mines de Ales, France;
- Andrea Emilio Rizzoli, Università della Svizzera Italiana, Switzerland;

Description of the International PhD Program in Strategic Engineering



Project Academic Committee (PAC): PAC Members

- **Patrizia Bagnerini, Genoa University, Italy;**
- **Alessandro Bruzzone, Genoa University, Italy;**
- **Elvezia Maria Cepolina, Genoa University, Italy;**
- **Carmine Cerrone, Genoa University, Italy;**
- **Stefano Dominelli, Genoa University, Italy;**
- **Ilaria Ferrando, Genoa University, Italy;**
- **Danilo Percivale, Genoa University, Italy;**
- **Marco Remondino, Genoa University, Italy;**
- **Anna Sciomachen, Genoa University, Italy;**
- **Cesare Stabilini, Genoa University, Italy;**
- **Emilio Jiménez Macías, Universidad de la Rioja, Spain;**
- **Julio Blanco Fernandez, Universidad de la Rioja, Spain;**
- **Javier Tardáguila, Universidad de la Rioja, Spain;**
- **Luis María López González, Universidad de la Rioja, Spain;**
- **Francisco Javier Martínez de Pisón, Universidad de la Rioja, Spain;**
- **Mercedes Pérez de la Parte, Universidad de la Rioja, Spain;**
- **Juan Carlos Sáenz-Díez Muro, Universidad de la Rioja, Spain;**
- **Eduardo Martínez Cámara, Universidad de la Rioja, Spain;**
- **Luis María López Ochoa, Universidad de la Rioja, Spain;**
- **Levente Kovács, Óbuda University, Hungary;**
- **József K. Tar, Óbuda University, Hungary;**
- **Aurél Galántai, Óbuda University, Hungary;**
- **Imre J. Rudas, Óbuda University, Hungary;**
- **László Gulácsi, Óbuda University, Hungary;**
- **Miklós Kozlovsky, Óbuda University, Hungary;**
- **Tamás Haidegger, Óbuda University, Hungary;**
- **László Horváth, Óbuda University, Hungary;**
- **Andrea Emilio Rizzoli, Università della Svizzera Italiana, Switzerland;**
- **Nicolas Daclin, IMT Ecole des Mines de Ales, France;**
- **Francois Trouset, IMT Ecole des Mines de Ales, France;**
- **Gregory Zacharewicz, IMT Ecole des Mines de Ales, France;**
- **Souad Rabbah-Chaniour, IMT Ecole des Mines de Ales, France;**
- **Vincent Chapurlat, IMT Ecole des Mines de Ales, France;**
- **Pierre Couturier, IMT Ecole des Mines de Ales, France.**

Description of the International PhD Program in Strategic Engineering



Program

Each Partner University will contribute the creation of The Committees (i.e. PSC, PAC, PEC) of the PhD Program.

The PSC (Project Steering Committee) organizes 2 Annual General Meetings each year to define guidelines and initiatives within the **Strategic Engineering PhD Program** and coordinate International Activities as well as to review the status of Researches, Developments and Students. The PAC (Project Academic Committee) is responsible for directing this PhD Program in synergy with his own Institution and to coordinate internal activities. The PEC (Project Expert Committee) includes experts, reviewers and observers devoted to supervise PhD Students and suggest R&D activities

Each Partner Organization will be able to contribute by providing PhD Courses that could be defined as mandatory or optional in the program and that are usually based on 15-25 hours delivered live, blended or just using web technologies. Exercise and Virtual Experiences based on Modeling and Simulation as well as Role Play Game with top experts will be offered to the PhD Students to extend their expertise in applying **Strategic Engineering** concepts and notions to real problems.

Each Partner University will contribute with regular PhD Grants based on its own regulations and the Program will operate based on 6 grants per year shared among Partners Institutions. This PhD Program is based on a 3 year program as basic duration for achieving the PhD. Selection will be based on Curriculum Vitae Review and Live Interview in compliance with the Criteria of the Different Partners and Nations and it will allow to select top quality candidates with great potential and strong foundations in modeling, analysis, decision making; due to the trans-disciplinary nature of this PhD, the PhD Program will encourage young engineers, scientists, people with Masters of Sciences in Informatics, Economics, International & Law Affairs to apply.

After selection each PhD Student will submit a Research & Development Proposal addressing **Strategic Engineering** and Modelling applied to a specific domain. The International Council of the PhD Program is in charge to refine and accept the proposals as well as to assign a Primary and a Secondary Supervisors belonging to two of Partner Universities as well as a Third Part Reviewer that will complete the Advisor Team.

Description of the International PhD Program in Strategic Engineering



The Advisor Team guides the PhD Students along their 3 year program and is in charge of review and approval of their Research Presentations and Synthesis to be submitted each year. At the successful completion of their work, each PhD Student will submit his final Thesis and proceed with a Defense to be carried out in front of the International Council for achieving the PhD title.

The Supervisors assign to each Student a mix of PhD Courses (usually 6 of ~20 hours each) based on his interest and Research subject to extend his knowledge. The PhD Courses should be completed along the whole 3 years program (usually on the first two years, to finalize Thesis on 3rd year). In case of contingencies or problems, the PhD Students are entitled to require an extension of PhD duration.

PhD Courses are delivered by the different Partner Universities and are open to be accessed and completed live as well as remotely, by web technologies. In addition, the Students are also entitled to apply to replace some of the Regular PhD Exams with up to 1 High Level Course per year (maximum 3 in total over 3 years) that he plans to attend in external qualified Organizations (e.g. NATO M&S Advanced Course); these applications are evaluated by the Advisor Team based on provided documentation and motivation.

The final Defense will be based on acceptance of his final Thesis by the Advisor Team composed by Primary, Secondary Supervisors and Third Part Reviewer, plus a specific version of his Presentation to be delivered in front of International Council. The **Strategic Engineering PhD Award** will be officially produced by Primary and Secondary Institutions for each Student, the award will include a specific reference to this Joint PhD Program as well as to the cooperation among all Partner Universities. The **Strategic Engineering PhD** is going to be active for next 5 years and starts in each Institution in consistency with local regulation.

Description of the International PhD Program in Strategic Engineering



Contents

The area of interest related to **Strategic Engineering** is related to majors so the Research and Developments in this PhD Program will focus on modeling, simulation, data analytics, artificial intelligence, operational research, open source intelligence, business intelligence, decision making, cyber and hybrid scenarios, multidomain models, extended reality as well as in the application areas including among others: Defense, Homeland Security, Industry, Business, Economy, Geo Politics, International & Law Affairs.

- **Knowledge and Understanding Skills on:**

- **Strategic Engineering**

- Complex Systems
- Computational Intelligence & Artificial Intelligence (AI)
- Conflict Management
- Crowdsourcing
- Cultural Elements of different Cultures (e.g. Africa, China)
- Cyber Security
- Defense & Aerospace Strategies
- Decision Making
- Game Theory
- Health Care Strategies
- Homeland Security
- Human Behavior Modeling
- Hybrid Threats
- Industrial Strategies
- Innovation
- Intelligence
- International & Law Affairs
- Logistics & Supply Chain Management
- Modeling
- Operational Research
- Organization Management
- Project Management
- Population Modeling
- Risk Analysis
- Sanitation, Hygiene
- Simulation
- Strategies in Economy
- Strategies in Informatics & Communication Technologies
- Strategies in Industrial Plants
- Strategic Planning & Management

Description of the International PhD Program in Strategic Engineering



Systems Engineering
Water Strategies

- **Intellectual Skills**

Analysis of Complex System
Critical Factors & Variables identification
MOM (Measures of Merit) & KPI (Key Performance Indicators) Design
Model Development
Solution Implementation

- **Practical Skills:**

Business Intelligence
Complex Systems Modeling
Crisis Management
Data Mining & Data Farming
Design and Development of Decision Making Solutions
Evaluation of Risk and Opportunities
Interaction with Strategic Decision Makers in Defense, Industry and Business
Legal Analytics
Open Source Intelligence
Operation Support
Operational Planning
Processes Re-engineering
Scenario Analysis
Smart Negotiation
Mobility and logistics

- **Transferrable Skills:**

Computer Assisted Exercises
Organization and Management of Exercises and AARs (After Action Reviews)
Support to Decision Making Process on the Field
Support Training and Education Initiatives
Table Top Exercises

Description of the International PhD Program in Strategic Engineering



Candidates

There are different types of potential Candidates for the **Strategic Engineering PhD Program**

- **Regular PhD Grants**
Graduated Scientists and Engineers with a Master for regular PhD Grants
- **Executive PhD Positions**
Military Officers and Commanders with Master and Experience •&
Managers & Executive with Master and Experience

Executive PhD Positions

In addition to regular PhD Grants it will be possible by Industries, Companies, Agencies and Institutions (e.g. MSCOE) to activate some Executive PhD Opportunities for his own Scientists & Officers based on a basic tuition fee and accepting that the candidates should meet all regular requirements as well as to complete successfully PhD Program; in facts, the Executive PhDs are subjected to all requirements and regulations of Regular PhD and allow to obtain a final full PhD Award, the only difference is that there is not a grant for the students considering that usually they received already a salary much higher by the sponsors or other organizations.

Institutional and Industrial Partners of the PhD Program in **Strategic Engineering**

Several Major Institutions and Agencies (e.g. NATO M&S COE, Water Academy), as well as Industries, plan to be active Partners of this new International PhD Program in **Strategic Engineering** getting access to special benefits due to his Importance and Role on Modeling and Simulation that represents a major pillar of this new discipline
Institutional and Industrial Partners have access to benefits for being active in this initiative. In particular, Institutional and Industrial Partners are entitled to appoint their own Experts in the International Council of the PhD Program and to be part of the Advisor Team for specific PhD students active on Thesis of their own Interests. Institutional and Industrial Partners are entitled to be part of Selection Committee with representative of Partner Universities to identify and evaluate candidates as well as to propose Topics and Research for the selected student Project of Work. Institutional and Industrial Partners participate in the Council for yearly Review Sessions of PhD Students and on the Final Defense Sessions

Description of the International PhD Program in Strategic Engineering



Institutional and Industrial Partners should contribute with a minimum of 1 PhD Grant to be assigned to a member University of this Program and obviously the sponsor will define related Project of Work and are active part of related Advisor Team

Industrial Institutional and Industrial Partners are approved to activate, on demand, additional Executive PhD positions for their own staff or people involved in the organization; these position will act without scholarship (being already sponsored internally to their Organizations) and will respect all the related procedures for selection, research and awarding of regular PhD. Institutional and Industrial Partners as PhD Program Partners could organize Joint PhD Courses and/or Educational Packages on advances in **Strategic Engineering**, Modeling & Simulation et cetera in accordance with Universities.

Language

All Material, as well as Official Language, for this PhD Program is English. Specific modules or contents in other Languages, devoted to support Multi Cultural Background Development, could be present as additional material and options.

Classification & Confidentiality Issues

This PhD Program is not CLASSIFIED and most material is Approved for Public Release. All major elements are characterized by being distribution unlimited.

Therefore, some specific Activities, Exercise or Subject, should be organized on sensitive subjects jointly with some Partners, in such case they could result to be restricted, classified or for eyes only of specific Nations or Organizations.

In case a PhD Research includes some sensitive material, all involved people, including students and reviewers, should hold proper Security Clearance in accordance with the regulations of the Nation and of the Alliance.

The Final Thesis and Presentation are public, so specific releases of these deliverables should be prepared in order to get them totally free from any sensitive information, data or concept and it should be approved for Public Release by the Institutions and Entities supervising the Thesis.

Description of the International PhD Program in Strategic Engineering



Points of Contact (POC):

Agostino Bruzzone, Elvezia Cepolina, Anna Sciomachen, Zsuzsanna Bácskai,

agostino@itim.unige.it, elvezia.maria.cepolina@unige.it, sciomach@economia.unige.it,
bacsikai.zsuzsanna@nik.uni-obuda.hu