POLITECNICO DI MILANO

PhD in INGEGNERIA AEROSPAZIALE / AEROSPACE ENGINEERING - 41st cycle

ACN - CYBER Research Field: AGENZIA PER LA CYBERSICUREZZA NAZIONALE (ACN) GRANT CYBER THREAT IDENTIFICATION AND MITIGATION IN THE NEW SPACE ERA

Monthly net income of PhDscholarship (max 36 months)
1600.0 In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	PhD candidates admitted under this call are subject to the obligations established in Articles 4 (PhD Candidate’s Duties), 5 (Intellectual Property and Research Results), and 9 (Revocations and Terminations) of the Regulation for Doctoral Programmes Funded by the Italian National Cybersecurity Agency (ACN) – 41st Cycle, available on the ACN website [AM1] (https://www.acn.gov.it) The PhD research will be carried out in collaboration with research groups of the PhD programme in "INFORMATION TECHNOLOGY", more specifically in the area of Computer Science and Engineering.For further details: https://www.dottorato.polimi.it/en/phd-programmes/engineering/information-technology. The New Space era is here to stay. Modern satellite infrastructures are evolving rapidly thanks to the introduction of new technological and commercial paradigms. The near-Earth space, once a prerogative of few national agencies, is now accessible to a wider community. Private companies develop nano-to-large satellites regularly. Constellations made of thousands of satellites are the standard and the adoption of models such as Satellite-as-a-Service (SataaS) are redefining the space sector. However, these transformations introduce new attack surfaces and systemic vulnerabilities, necessitating specific cybersecurity solutions. All in all, new technologies and tools must be devised to protect the space sector.The PhD will focus on the analysis of threat models in modern satellite infrastructures, emphasizing

	vulnerabilities introduced by new orbital architectures and emerging paradigms like Satellite-as-a-Service (SataaS) and satellite data centres. Potential cyber and cyber-physical attack chains that could compromise space operations will be examined. Key areas of investigation could include supply chain compromises, intrusions into mission control systems, inter-satellite link (ISL) vulnerabilities, manipulation of telemetry and control data, and advanced spoofing, jamming, and signal hijacking techniques.To enhance understanding and resilience, threats and countermeasures shall be integrated into a satellite cyber range designed for realistic simulation and training. This environment supports multi-physics modelling of the space segment to evaluate the operational impact of simulated attacks. The broader objective is to develop a realistic representation of threat dynamics and enable the automated assessment of cyber risks in satellite ecosystems, supporting training, preparedness, and the strengthening of cybersecurity capabilities in the space domain [AM1]I dottorandi ammessi nell'ambito del presente bando sono soggetti agli obblighi previsti dagli articoli 4 (Obblighi del dottorando), 5 (Proprietà intellettuale e risultati della ricerca) e 9 (Revoche e decadenze) del *Disciplinare per i dottorati finanziati da ACN – XLI ciclo*, disponibile sul sito dell'Agenzia per la Cybersicurezza Nazionale (https://www.acn.gov.it).
Methods and techniques that will be developed and used to carry out the research	The proposed PhD project combines renown expertise in the field of space systems modelling and simulation, and of cybersecurity threat modelling (with a specific emphasis on the peculiarity of cyber-physical systems). These two branches are both at the edge of research in their fields, and they are merged here to forge a novel research line. Established cybersecurity frameworks, including MITRE ATT&CK and SPARTA, could be adapted to the "new space" domain to identify evolving threats and novel attack vectors.
Educational objectives	The objective of this PhD is to develop skills in space system modelling and simulation to be combined with skills and expertise in cyber security, with application on

	space system. The candidate will also gain acquire experience in near-Earth space missions.Moreover, the candidate will develop skills on both computer and processor/hardware-in-the-loop simulations. Soft skills in disseminating the research, writing reports, performing outreach, and preparing industrial progress meetings will be also achieved through the PhD project.In addition, the PhD student is supposed to spend 6 months in a foreign university/research centre/company. The timeframe and location of the period abroad will be defined during the PhD career development plan, to be developed within the first semester after the kick-off of the activity.Finally, by working in a mixed and vibrant academic and industrial context, the candidate will learn on the job several transferable skills, including communication skills, team working, leadership, and ethical aspects associated with the use of innovative technologies.
Job opportunities	The current research prepares the PhD candidate to both academic and industrial careers. Knowledge of model-based system engineering, modelling and simulation of space systems, as well as space system cyber security are fundamental skills for careers in space-related companies and universities.
Composition of the research group	1 Full Professors 1 Associated Professors 5 Assistant Professors 25 PhD Students
Name of the research directors	Alessandro Morselli

Contacts
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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

Scholarship Increase for a period abroad	
Amount monthly	750.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
The PhD candidate will receive a desk, possibly through a hot-desking procedure, and a personal computer, if needed. Apart from the compulsory ones, the PhD candidate will have the opportunity to follow additional courses and receive economic support to attend summer schools and participate in conferences. There will be the possibility of paid teaching assistantship.