POLITECNICO DI MILANO

PhD in INGEGNERIA AEROSPAZIALE / AEROSPACE ENGINEERING - 41st cycle

THEMATIC Research Field: NEW POWER MANAGEMENT SOLUTIONS FOR LARGE INFRASTRUCTURES IN SPACE

Monthly net income of PhDscholarship (max 36 months)
1500.0 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	The power generation and management is crucial in any space mission. The current short and long term roadmap for the space activities and exploration makes evident that a step further in the traditional power generation, distribution and control is requested, first of all to support future manned lunar outposts. Electric power management for large infrastructures on orbit and on planetary surface Is crucial for any complex activities mission shall perform in the future. Nowadays the most complex electric power management architecture is represented by the International Space Station which is still a pathfinder, even if a bit old. The future sees multiple complex plants, on orbit and on planetary surfaces (the Moon first, the Mars next), to be considered as nodes of a power distribution network of systems of systems, with a variety of power sources and energy transfer strategy (wired, wireless), with a strong intrinsic robustness to be failure limited and to support automatic recovery. While such power distributions network could be considered the state of the art on Earth, that’s not the case in space, therefore there is room to investigate how far the technological spin in could hold and form where new, customized solutions are needed. The research focuses on investigating the best tailored architecture for the electric power management and distribution for a variety of future large infrastructures in space. Particular attention is devoted to maximise the spin in technological knowhow the involved company (ABB) has. The use case will be

	the manned lunar bases to build up a virtual model of the electric power substystem to support both design assessment and operations simulations. The virtual model is expected to be validated through real data provided by the company.
Methods and techniques that will be developed and used to carry out the research	The research will be developed in strict collaboration with ABB as leader in Earth based electric power management and equipment. Activities will be primarily numerical to develop the digital model of the possible power management planetary grid. Experimental activities will be considered as a possibility along the PhD carrier, supported primarily by the company infrastructures. A period between 6 and 12 months, not necessarily continuous, might be spent at external premise to deepen specific topics related to the research, such as the Space environment modelling and characterization. The doctoral student will follow doctoral courses at the Doctoral School of the Politecnico di Milano, selected to enhance his/her competences in the fields related to the research topic.
Educational objectives	The specific objective of this PhD is to develop skills in space exploration system engineering with particular attention to the electric power resource management in the framework of large and heterogenous planetary infrastructures to support manned missions, primarily, not limited to, on the Moon. Being the research area intrinsically multidisciplinary, the candidate will gain competences in multiphysics modelling, space systems design and operations, electric subsystem design and operation, and planetary science.
Job opportunities	The job opportunities that this project opens up are in the field of space system engineering, from the design to the implementation and operations management. Skills acquired will give access to jobs related to complex and technologically advanced plants engineering and management in both Space and Earth industrial fields
Composition of the research group	1 Full Professors 0 Associated Professors 3 Assistant Professors

	13 PhD Students
Name of the research directors	Michèle Lavagna

Contacts
Dipartimento di Scienze e Tecnologie Aerospaziali - Politecnico di Milano - via La Masa 34, 20156 Milano - Italy - tel. +390223998323 - fax +390223998334 - email: Michèle Roberta Lavagna <michelle.lavagna@polimi.it> - web site: www.aero.polimi.it

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.