Purdue University

School of Materials Engineering 690 Seminar Series

Date: Monday, Nov. 25, 2013

Time: 3:30 Refreshments
3:45 Seminar

Place: ARMS 1010

PURDUE MATERIALS ENGINEERING

Infinite Possibilities

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ABSTRACT

Microgravity: the future of innovation

The International Space Station is a US taxpayers investment estimated at about $70 billion spent over 30 years (with an overall price tag of $100 billion by all member nations), thus it is natural to ask about the ISS's Return on Investment to justify its continuous operation and existence its scientific payoff. While this is not a trivial financial question, a more appropriate measure for the ISS would be the Return on Innovation phrased from the perspective of: "What is the cost of NOT innovating and NOT exploring in microgravity?" This simply correlates with the otherwise-not-accessible-knowledge, the number of unique "lessons learned" and discoveries, especially those that enable humanity to pursue solutions for global critical problems and open up new avenues in areas at big impasse. To add to it, maybe space is the necessary step that humanity will have to undertake to progress, to change consciousness and awareness and to encourage creative cooperation coupled with a communitarian view of Earths future.

ISS is a top engineering achievement in space harboring a myriad of outstanding fundamental scientific investigations. There is a growing interest in highlighting the ISS achievements especially from the perspective of their impact on terrestrial technologies and by being the source of a cascade of accomplishments and developments ranging from the seed scientific discoveries to direct applications, many of them serendipitous in nature. The ultimate goal is to build upon these successes to increase the potential of commercialization and to create a stable, self-sustainable space based market. An overview of already identified microgravity benefits to material and life sciences will be given as well as examples highlighting the breadth of these scientific investigations and the aforementioned serendipitous effects. The value of a space-based novel initiatives will be explored with specific examples in the works.

The talk will also touch upon the need for a customized on-demand payload return from the ISS to augment the current payload downmass to Earth and increase the ISS commercialization potential. The existing transportation infrastructure is correlated with the current ISS utilization demands in terms of bulk downmass and schedule frequency and it is operated by the SpaceX Dragon Capsule and the Russian Soyuz with a combined frequency of about three to seven times per year. Based on previous experience with commercial partners it appears that a customized on-demand payload return system better meets the customers' needs and directly encourages potential emerging markets of ISS users. The talk will briefly step through the rationale behind defining a metric (requirements and design functions) that identifies/assigns quantifiable system level parameters to capture the various aspects of the need for a customized on-demand payload return from the ISS.

ISS is the first platform of its kind that enabled long term human presence in space, long term exploration of skills needed to survive the extreme environment, long terms exposure of basic scientific experiments to the microgravity environment. *No matter what angle we look at it, the ISS is first and foremost a learning platform. As such its primary role is to help answer fundamental questions about living and working in space and help figure out the capabilities we need that we don't have to ensure a future sustainable human exploration:* one facet oriented towards the depths of space, the other towards Earth.

SHORT BIO

Dr. Ioana Cozmuta is a Senior Research Scientist/Engineer with Science and Technology Corporation. Ioana has a MSc in Biophysics and Medical Physics and a PhD in Applied Physics from University of Groningen, the Netherlands followed by two research associate positions at California Institute of Technology (computational chemistry in the Material and Process Simulation Center, prof. W. A. Goodard) respectively Stanford University (Biochemistry, School of Medicine). Ioana started at NASA supporting the Center for Nanotechnology in the development of a solid-state nanopore sensor for DNA sequencing then switched to an engineering job by performing Stardust postflight analysis and sensitivity analysis for the margins assessment of TPS systems. Ioana was the Material Response Lead for the Mars Science Laboratory Entry Descent and Landing Instrumentation, the Lead of the TPS Margins team under the Orion/CEV project. Ioana is and has been active as Co-PI in several proposals (NASA, AFOSR) in the field of surface catalysis and gas-surface interactions for hypersonic conditions and development and validation of high fidelity ablation models. She is the founding chair of the first Gordon Research Conference on Atmospheric Reentry Physics, Fundamentals of Environment-Materials Interactions, Models and Design Approaches to Meet Emerging Space Needs. Currently Ioana is the Microgravity and Innovative Strategies Lead supporting the Space Portal and the Emerging Space Office at the NASA Ames Research Center. Ioana's work specifically aims at identification and consolidation of microgravity benefits to support key US ground technologies from the perspective of IP generation and disruptive innovation.