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International Executive Committee

CSA

Martin Picard

DLR

Bernd Sommer

ESA

Gianfranco Visentin

JAXA

Hiroshi Ueno

ISAS/JAXA

Takashi Kubota

NASA

Richard J. Doyle

JPL

Richard Volpe

Sponsored by



Programme Overview

Sunday 3 June 2018	
18:30	Pre-registration
18:30 – 19:30	Welcome Cocktail

Monday 4 June 2018			
07:45	Registration		
08:40 – 08:50	Welcome and Introduction		
08:50 – 10:30	Session 1: Programmatic		
10:45 – 12:25	Session 2a: Mobility Analysis	Session 2b: Orbital Missions	Session 2c: Spacecraft Autonomy 1
13:35 – 15:15	Session 3a: Mobility in Low Gravity	Session 3b: Orbital Robotics Technologies	Session 3c: Spacecraft Autonomy 2
15:30 – 17:45	Session 4a: Mobility Planning 1	Session 4b: Robotic Testing Facilities	Session 4c: Autonomous Science
17:45 – 19:15	Cocktail + Poster Session		

Tuesday 5 June 2018

08:45 – 09:15	Plenary Talk		
09:25 – 10:55	Session 5a: Mobility Planning 2	Session 5b: HRI	Session 5c: Robot Swarms 1
11:10 – 12:50		Session 6b: Robotic Software Engineering	Session 6c: Robot Swarms 2
14:00 – 14:30	Plenary Talk		
14:40 – 16:20	Session 7a: Planetary Perception and Navigation 1	Session 7b: Orbital Missions 2	Session 7c: Robot Mechanism DDV
16:35 – 18:15	Session 8a: Planetary Perception and Navigation 2	Session 8b: Orbital Perception and Navigation	Session 8c: Hoppers
20:00	Conference Dinner Departure		
20:30	Dinner		

Wednesday 6 June 2018

08:45 – 09:15	Plenary Talk		
09:25 – 10:55	Session 9a: Perception 1	Session 9b: Robot Control	Session 9c: Autonomy Frameworks
11:10 – 12:25	Session 10a: Perception 2		Session 10c: Robots and ISRU
14:00	Technical Tour		
19:30	Arrival back at the Hotel		

Sunday 3 June 2018

- 18:30 Pre-registration
18:30 Welcome Cocktail
19:30 End of the Welcome Cocktail

Monday 4 June 2018

- 07:45 Registration

Welcome and Introduction

Room: Europa

- 08:40 Welcome and Introduction
J. Gavira

Session 1: Programmatics

Room: Europa

Chair: J. Gavira

- 08:50 AI and Space robotics at ESA 2018
G. Visentin, European Space Agency
- 09:15 [Automation and Robotics within the German Space Programme](#)
B. Sommer
- 09:40 [2018 Robotics Activities at JPL](#)
R. Volpe
- 10:05 [AI and Space Robotics Activities in JAXA](#)
T. Kubota
- 10:30 Coffee break

Session 2a: Mobility Analysis

Room: Europa

- 10:45 [Including the effect of gravity in wheel/terrain interaction models](#)
B. Ghotbi

Proceedings - i-SAIRAS 2018, 4-6 June, Madrid, Spain

- 11:10 [Gait Analysis of a Free-Climbing Robot on Sloped Terrain for Lunar and Planetary Exploration](#)
Y. Shirai
- 11:35 [Lunar Pit Exploration with Probe Launching System](#)
H. Arisumi

Session 2b: Orbital Missions

Room: America

Chair: B. Sommer

- 10:45 [Readiness of proximity operation on MINERVA-II rovers onboard Hayabusa2 asteroid explorer](#)
T. Yoshimitsu
- 11:10 [Development of Mini Space Elevator Demonstration Satellite STARS-Me](#)
M. Nohmi
- 11:35 Bartolomeo - A New Facility on the International Space Station Well-Suited for Artificial Intelligence, Automation and Robotics Payload Hosting
K. Pegg

Session 2c: Spacecraft Autonomy 1

Room: London

Chair: G. Visentin

- 10:45 [Embedding a Scheduler in Execution for a Planetary Rover](#)
S. Chien
- 11:10 [Development of Low-cost and High Performance Attitude Sensor applying Neural-network Image Recognizing Technology](#)
Y. Kikuya
- 11:35 [Monte Carlo Squeaky Wheel Optimization Scheduler Priority Management for an Onboard Planetary Rover Scheduler](#)
S. Chien
- 12:00 [Fault-Tolerant Plan Validation for Europa Clipper](#)
S. Schaffer (S. Chien)

12:25 Lunch break

Session 3a: Mobility in low gravity

Room: Europa

Chair: T. Kubota

13:35 [Hopping simulation for small rover using regolith model considering the result of vacuum and small gravity flight experiment](#)

T. Maeda

14:00 [Locomotion in uncertain low-gravity environments: preparing for the Mascot mission](#)

F. Wolff

14:25 [Simulation Study on Landing Behavior of Spacecraft in Microgravity Environment based on Multibody Dynamics Model](#)

H. Katsumata

14:50 [Experimental Analysis on Landing Dynamics of Martian Moon Spacecraft based on Similarity Law](#)

D. Yamaguchi

Session 3b: Orbital Robotics Technologies

Room: America

Chair: S. Aziz

13:35 [Robot Servicer Interaction with a Satellite During Capture](#)

J. Brannan

14:00 [Reaction Force Observer for a Free-Floating Robot](#)

D. Hirano

14:25 [Parametric Analysis on Repeated Impact-based Capture of a Free-Floating Cylindrical Object by a Dual-Arm Space Robot](#)

N. Hase

14:50 [Parameter Identification of a Space Object in the Pre-capture Phase](#)

O. Christidi-Loumpasefski

Session 3c: Spacecraft Autonomy 2

Room: London

Chair: S. Chien

- 13:35 [Experiments in Segmenting Mars Craters using Convolutional Neural Networks](#)
D. DeLatte
- 14:00 [Terrain classification with an omni-directional camera based on convolutional neural network](#)
Y. Suebe
- 14:25 [Predicting non-geometric hazards using machine learning for safer rover mobility operations](#)
M. Faragalli
- 14:50 [Deep Learning Based Pose Estimation in Space](#)
D. Hirano
- 15:15 Coffee break

Session 4a: Mobility Planning 1

Room: Europa

Chair: C. Pérez Del Pulgar

- 15:30 [A Lunar Micro Rover Path Planning based on Environmental Constraints](#)
T. Oikawa
- 15:55 [Multi-scale Path planning for a Planetary Exploration Vehicle with Multiple Locomotion Modes](#)
J. Ricardo Sánchez Ibáñez.
- 16:20 [Efficient gait selection for quadrupedal robots on Moon and Mars](#)
H. Kolvenbach
- 16:45 [Path Planning with Risk Consideration by Hopping Mobility for Long Distance Traversability](#)
Y. Kunii

Session 4b: Robotic testing facilities

Room: America

Chair: J. Rodriguez Gonzalez

- 15:30 [The DLR Terramechanics Robotics Locomotion Lab](#)
F. Buse
- 15:55 [ORGL – ESA’s Test Facility for Approach and Contact Operations in Orbital and Planetary Environments](#)
M. Zwick
- 16:20 [Preliminary Investigations on Ground Experiments of Variable Shape Attitude Control for Micro Satellites](#)
Y. Shintani
- 16:45 [Full lifecycle support for modular satellite systems provided by comprehensive Virtual Testbeds](#)
T. Osterloh

Session 4c: Autonomous Science

Room: London

Chair: L. Joudrier

- 15:30 [Cloud Filtering and Novelty Detection using Onboard Machine Learning for the EO-1 Spacecraft](#)
S. Chien
- 15:55 [Novelty or anomaly hunter – driving next-generation science autonomy with large high quality dataset collection](#)
M. Woods
- 16:20 [Self-Reliant Rovers for Increased Surface Mission Productivity](#)
D. Gaines (S. Chien)
- 16:45 [Heuristic Guided Orbit Selection for a Low Frequency Radio Interferometric Spacecraft Constellation: Summary Report](#)
S. Chien
- 17:45 Cocktail + Poster Session
- 19:15 End of day 1

Tuesday 5 June 2018

Plenary Talk

Room: Europa

- 08:45 [TG-2 Robotic Task: China's Robot On-Orbit Servicing Experiment In the Spacelab](#)
Z. Li

Session 5a: Mobility Planning 2

Room: Europa

Chair: D. Wettergreen

- 09:25 [The LUCID field test campaign – Results of operations with a rover in a similar lunar environment](#)
F. Gandia
- 09:50 [RaCER: Determination of the maximum speed of the fast teleoperated rover for lunar exploration](#)
P. Wittels
- 10:15 [Image based Behavior Planning Scheme for Autonomous Planetary Exploration Rover](#)
M. Sakuta
- 10:40 [Overcoming the Challenges of Solar Rover Autonomy for Long-Duration Planetary Navigation](#)
O. Lamarre

Session 5b: HRI

Room: America

Chair: M. Picard

- 09:25 [Intuitive “human-on-the-loop” interface for teleoperating remote mobile manipulator robots](#)
K. Kruusamäe
- 09:50 [Multisensory real-time space telerobotics. Development and analysis of real-time telerobotics systems for space exploration](#)
M. Ferraz

10:15 Lean lunar rover mission control: human-machine interface design following User Centered Design principles

O. Gásquez García

10:40 [SOLEUS : Space Countermeasure with Ankle Foot Orthosis, Scientific Evaluation and Perspectives](#)

P. Letier

Session 5c: Robot Swarms 1

Room: London

Chair: R. Volpe

09:25 [Preliminary Studies on Computation Sharing in Mars Spacecraft Network](#)

T. Vaquero (J. Wyatt)

09:50 [Physically Distributed Control and Swarm Intelligence for Space Applications](#)

A. Redah

10:15 [Swarm Technologies for Future Space Exploration Missions](#)

E. Staudinger

10:40 [Termite algorithms to control collaborative swarms of satellites](#)

H. Hildmann

10:55 Coffee break

Session 6b: Software Engineering

Room: America

Chair: M. Azkarate

11:10 [Flight System Architecture of the Sorato Lunar Rover](#)

J. Walker

11:35 [Astrobee Robot Software: Enabling Mobile Autonomy on the ISS](#)

L. Fluckiger

12:00 [cFE Extension for the Use of ROS Applications in the Space Missions](#)

T. Saito

12:25 [Binary software packaging for the Robot Construction Kit](#)

T. Roehr

Session 6c: Robot Swarms 2

Room: London

Chair: D. Nölke

11:10 [Strategic Deployment and Rerouting Methods for Wide-range Surface Exploration using Multiple Rovers](#)

R. Nakanishi

11:35 [Multi-rover Coordination Algorithms for Autonomous Planetary Cave Exploration](#)

T. Vaguero (E. Jay Wyatt)

12:00 [Monitoring and controlling of modular meshed networks](#)

D. Timmermann

12:25 [Autonomous Networking for Robotic Deep Space Exploration](#)

E. Jay Wyatt

12:50 Lunch break

Plenary Talk

Room: Europa

14:00 [Automated Detection and Tracking of Plumes at 67P/Churyumov-Gerasimenko in OSIRIS/Rosetta image sequences: Summary Report](#)

S. Chien

Session 7a: Planetary Perception and Navigation 1

Room: Europa

Chair: J. Hidalgo Carrió

- 14:40 [SPARTAN: Vision-Based Autonomous Navigation System for Fast Traversal Planetary Rovers](#)
M. Avilés
- 15:05 Adaptive SLAM for Autonomous Planetary Exploration using Global Map Matching
M. Azkarate
- 15:30 [Exploration in inaccessible terrain using visual and proprioceptive data](#)
D. Kuehn
- 15:55 [Exomars visloc – the industrialised, visual localisation system for the exomars rover](#)
M. Woods

Session 7b: Orbital Missions 2

Room: America

Chair: S. Aziz

- 14:40 [A Study of an Astronaut Support Robot with a Morphable-beam-based Extendable Arm](#)
H. Nakanishi
- 15:05 [Crew-supportive Autonomous Mobile Camera Robot on ISS / JEM](#)
S. Mitani
- 15:30 [Underactuated gripper design for the assembly of infrastructure in space](#)
N. Mulsow
- 15:55 No presentation scheduled

Session 7c: Robot Mechanism DDV

Room: London

Chair: M. Zwick

- 14:40 [Evolution of the ExoMars Sample Crushing Unit from Breadboard to Flight Model](#)
D. Redlich
- 15:05 [ExoMars Rover Sample Handling System QM/FM Design and Testing](#)
R. Paul
- 15:30 [Actuator Development Projects in FY2017 in the Space Exploration Innovation Hub Center](#)
T.i Yano
- 15:55 No presentation scheduled
- 16:20 Coffee break

Session 8a: Planetary Perception and Navigation 2

Room: Europa

Chair: M. Woods

- 16:35 [Robust Localization of Mars Exploration Rover Using Geo-registration by Ground-to-Air Image Matching](#)
K. Ebadi
- 17:00 [Theoretical Analysis of Triangle Matching Method Based on Craters for Spacecraft Localization](#)
F. Uwano
- 17:25 [Sampling-based Descent Trajectory Planning and Autonomous Landing Site Selection for Icy Moon Missions](#)
A. Arora
- 17:50 [How to Detect Essential Craters in Camera Shot Image to Increase the Number of Spacecraft Location Estimation while Improving its Accuracy?](#)
H. Ishii (K. Takadama)

Session 8b: Orbital Perception and Navigation

Room: America

Chair: L. Joudrier

- 16:35 [Robust Model-Based Tracking for Active Debris Removal and Autonomous Rendezvous](#)
M. Avilés
- 17:00 [Motion Estimation of Axial Symmetry Object for Active Debris Removal Mission](#)
I. Takahashi
- 17:25 Satellite Inspection Applications of Reflectance Transform Imaging
W. Bezouska
- 17:50 [RVS3000-3D: LIDAR meets Neural Network](#)
C. Schmitt

Session 8c: Hoppers

Room: London

Chair: K. Yoshida

- 16:35 [Motion analysis of jump robot with tether for lunar exploration](#)
Y. Sugawara
- 17:00 [Traversability Analysis of Hopping Rovers on Small Solar System Bodies](#)
B. Hockman
- 17:25 [Design for wheel grouser geometry to direct a hopping rover](#)
M. Otsuki
- 17:50 [A Novel Small Hopping Robot with SMA Driven Legs for Lunar Exploration](#)
T. Sakamoto
- 20:00 Conference Dinner departure
- 20:30 Dinner

Wednesday 6 June 2018

Session 9a: Perception 1

Room: Europa

Chair: L. Joudrier

- 09:25 [Development of I3DS: an integrated sensors suite for orbital rendezvous and planetary exploration](#)
V. Dubanchet
- 09:40 [An SSDP based ICU for pre-processing and Control](#)
J. Manuel Rodriguez Bejarano
- 10:15 [High-performance Image Acquisition and Processing System for Space Debris Mitigation](#)
S. Kimura
- 10:40 No presentation scheduled

Session 9b: Robot Control

Room: America

Chair: Mini C. Saaj

- 09:25 [Optimal Control of a 3-DOF Free Floating Platform on a Flat Floor](#)
C. Velosa
- 09:40 [Hinfinity control for a controlled floating robotic spacecraft](#)
A. Seddaoui
- 10:15 [Automatic Levelling of a Platform to Achieve Artificial Gravity](#)
C. Velosa
- 10:40 [Effective and accurate method for ground and on-orbit verification of control systems for free-flying robot with low thrust force](#)
N. Tanishima

Session 9c: Autonomy Frameworks

Room: London

Chari: G. Visentin

- 09:25 [A Common Data Fusion Framework for Space Robotics - Architecture and Data Fusion Methods](#)
R. Dominguez
- 09:40 [CASE: A Cognitive Architecture for Space Exploration](#)
R. Bonasso
- 10:15 Performance of high-complexity algorithms for feature detection, image processing, and embedded visual odometry in a hybrid logic-software computing environment
E. Edwards
- 10:40 [Using the ERGO framework for space robotics in a planetary and an orbital scenario](#)
J. Ocón Alonso
- 10:55 Coffee break

Session 10a: Perception 2

Room: Europa

Chair: L. Joudrier

- 11:10 [Joint Visual and Time-Of-Flight Camera Calibration for an Automatic Procedure in Space](#)
T. Conceicao
- 11:35 [Quality of the 3D Point Cloud of a Time-of-Flight Camera under Lunar Surface Illumination Conditions: Impact and Improvement Techniques](#)
K. Uno
- 12:00 [Enabling active perception through data quality assessment: a visual odometry use case](#)
A. De Maio
- 12:25 No presentation scheduled

Session 10c: Robots and ISRU

Room: London

Chair: H. Ueno

- 11:10 [Towards In-Situ Supply Chain Manufacture of All-Purpose Magnetic Devices from Rare Earth Materials Mined from Asteroids](#)
A. Ellery
- 11:35 [Developing Techniques to 3-D Print Electric Motor](#)
A. Elaskri
- 12:00 [Requirements for a mobile lunar prototype for additive layer manufacturing](#)
A. Voß
- 12:50 Lunch break
- 14:00 Technical Tour
- 19:30 Arrival back at the hotel

Posters

- P.01 [Parametric influences on the behavior of planetary regolith using DEM simulation](#)
R. Lichtenheldt
- P.02 [Real-Time Implementation of a feature detection algorithm for usage in space applications](#)
S. Hardt
- P.03 Preliminary Design and Study of Performance of a High Mobility Sample Fetching Rover
J. Estremera
- P.04 [Retractable Anchors for Soft Sand Anchoring](#)
S. Lam
- P.05 [Destination Accessibility of a Hopping Robot on Small Bodies in Microgravity](#)
K. Kobashi
- P.06 [Automatic Experimental Design Using Deep Generative Models of Orbital Data](#)
A. Candela
- P.07 [Minimum Object Internal Force Trajectory Optimization For On-Orbit Dual-Arm Space Robots](#)
N. Mavrakis
- P.08 LUVMI: a rover platform for volatiles instruments operation at the Lunar poles
J. Gancet.
- P.09 [Comparison of Gabor Filters and Wavelet Transform Methods for Extraction of Lithological Features](#)
A. Tettenborn
- P.10 [Study on DEM Co-registration Algorithm for Improving Rover Landing Positioning Accuracy](#)
L. Feng
- P.11 [Utilization of the Field Robots of the Earth as to Realize the Moon life](#)
D. Takuji Ito

- P.12 VaMEx - LAOLa Valles Marineris Exploration - Local Ad-hoc Positioning- and Landing-System
T. Walter
- P.13 [Modelling of manipulator-satellite interaction using MATLAB/SIMULINK](#)
H. Jahn
- P.14 [Design and Implementation of a Hardware-in-the-loop Robotic Testbed for the European Robotic Arm's Wrist Cameras](#)
M. Krainski
- P.15 [Characterisation of Exomars rover wheel in Simulated partial Gravity](#)
P. Niskarat
- P.16 [Toward Automated Robotic Tasks in Microgravity using Assistive Free-Flying Spacecraft and Adhesive Grippers](#)
A. Cauligi