While the contributions of this session presented experimental work involving only a few robots (up to six), they leveraged radically different robotic platforms (quadrotors, miniature surface vessels and wheeled vehicles) confirming the recent trend of experimental diversification in distributed robotics. The classes of problem addressed were also varied: the work with aerial vehicles involved coverage missions, the contribution with surface vessels focused on loosely coordinated navigation across a stochastic field, and wheeled vehicles were used to investigate distributed learning policies. Although the approaches proposed took already into account realistic constraints of the robotic platforms (e.g., limited energetic autonomy, maneuverability, computational resources), only one contribution reported some initial field results outlining that it is still today quite difficult to gather systematic data of many-robot experiments outside the laboratory.

In the first paper, *Controlling Basin Breakout for Robots Operating in Uncertain Flow Environments*, C.R. Heckman, I.B. Schwartz and M. Ani Hsieh present their development and experimental validation of an autonomous surface/underwater vehicle (ASV/AUV) control strategy that leverages the environmental dynamics and noise to efficiently navigate in a stochastic fluidic environment. The environment is assumed to be tessellated in the so called Lagrangian Coherent Structures (LCS), structures that can be actually detected and leveraged in real oceans, typically for optimizing fuel consumption. The main contribution of the paper is to show how to formulate energy-efficient, minimal control laws able to leverage escape paths arising from noise-induced large fluctuations in order to navigate from one LCS-bounded region to another. The merit of the paper is to show how solid theoretical knowledge about the LCS can be translated into concrete control laws validated both in simulation and through an original laboratory test-bed.

The second and fourth papers in the session are concerned with distributed surveillance missions involving multiple quadrotors. In *QuadCloud: A Rapid Response Force with Quadrotor Teams*, the authors K. Mohta, M. Turpin, A. Kushleyev, D. Mellinger, N. Michael, and V. Kumar design their multi-robot system for achieving a fast response speed, for instance in case situational...
awareness must be rapidly acquired before the intervention of human rescue teams in a disaster scenario. The paper focuses on the integration of the various elements needed to achieve dependable operation of up to six quadrotors controlled by a single human operator. The merit of the paper is to report results related to an actual field deployment and to consider an end-to-end system. In *Provably Correct Persistent Surveillance for Unmanned Aerial Vehicles Subject to Charging Constraints*, the authors K. Leahy, D. Zhou, C. Vasile, K. Oikonomopoulos, M. Schwager, and C. Belta design their multi-robot system for achieving long-term patrolling of a given number of regions of interest. Their approach combines automata-based techniques (the constrained optimization problem is captured with Bounded Linear Temporal Logic) with a vector-field method assuming differentially flatness of the vehicle dynamics. In order to physically demonstrate the validity of the approach as well as the persistency of the surveillance, the contribution leverages original stations for automated charging of quadrotors. The merit of this paper is to show a concrete, provably correct solution for carrying out tasks lasting longer than the typical short battery life of current rotor-based aerial vehicles (30–60 min).

Finally, the third paper of the session, *Distributed Learning of Cooperative Robotic Behaviors using Particle Swarm Optimization* by E. Di Mario, I. Navarro, and A. Martinoli, proposes a method based on Particle Swarm Optimization for distributing the learning process across multiple robots. The method is robust to large parameter spaces (e.g., 26 real parameters per robot in the proposed case study) and achieves similar performances to those obtained using its centralized counterpart. The authors validate their method on a collaborative task (navigation in loose formation or flocking) involving a quantitative misalignment between local and global performance metrics used by the learning process in its distributed and centralized version, respectively. The merit of this paper is to show that distributed learning can deliver competitive performances even in collaborative tasks involving a large search space and to support this claim with a thorough experimental campaign based on high-fidelity simulations and real robots.