

## Coordination and Control of UAVs for Urban Operations

### *Organizers*

- Datta Godbole, Honeywell Labs, [datta.godbole@honeywell.com](mailto:datta.godbole@honeywell.com)
- Tariq Samad, Honeywell Labs, [tariq.samad@honeywell.com](mailto:tariq.samad@honeywell.com) [corresponding organizer]

### *Presenters*

- George Pappas, University of Pennsylvania
- John Bay, DARPA
- David Musliner, Honeywell Labs
- Siva Banda, Air Force Research Laboratory
- Shankar Sastry, University of California—Berkeley
- George Vachtsevanos, Georgia Tech
- Claire Tomlin, Stanford University
- Dale Enns, Honeywell Labs
- Francesco Borrelli, Universita del Sannio, Italy
- Sanjeev Singh, Carnegie Mellon University
- Marc Steinberg, Navair (invited)

This workshop will highlight recent advances in the coordination and control of unmanned aerial vehicles (UAVs) with specific reference to military operations in urban terrain (MOUT). Applications to MOUT are a relatively new driving force for defense-related R&D in UAVs. We have brought together a diverse group of speakers, representing industry, government, and academe, all of whom have been at the forefront of research in UAVs for urban applications. The speakers will review recent research results, present new UAV designs and multi-UAV developments, and discuss complexities associated with reconnaissance, surveillance, tracking, and other operations in densely populated cities. Technical topics we will cover include control design for unconventional small UAVs; UAVs as network-centric platforms, planning algorithms for multi-UAV urban missions; route optimization in obstacle-rich environments, and communication-constrained coordination algorithms.

*Proposed Length:* Full day

*Target Audience:* The workshop features presentations from industry, government, and academic perspectives and is targeted to students, academic researchers, and industry professionals. Attendees will gain a broad understanding of the technical and procedural complications associated with urban military operations; how UAVs promise to address many of these complications; the new types of UAVs, many of which impose challenges for control design and analysis, that are being developed for urban missions; various multi-UAV coordination and control concepts that are being explored; the state of the art in terms of theoretical results, vehicle developments, and operational demonstrations; and key topics for future research in this area.

*Workshop Program*

A general outline of the workshop is as follows:

- UAVs for MOUT: The challenge
  - Complexities of MOUT
  - Concepts of operation for UAV-equipped urban missions
- New UAVs for the urban environment
  - Modeling, analysis, and control of small UAVs
  - Sensing, communication, and coordination capabilities
- Single-UAV applications
  - Autonomous navigation with onboard sensors
  - Target tracking with vision feedback
  - Route optimization in obstacle-rich environments
- Multi-UAV coordination and control
  - Coordinated area surveillance
  - Distributed conflict avoidance and airspace management in the urban environment
  - Communication-constrained cooperative control
  - Planning and scheduling for multi-UAV missions
- Government perspectives
  - Current initiatives and results
  - Future research needs

Talks will be 30-45 minutes. Several will feature videos of new vehicles and urban-environment demonstrations.

#### *Workshop Proceedings*

Copies of all the presentations will be made available to the workshop participants.