

Tutorial – T4 (Half Day)

TOWARDS NETWORKED AIRBORNE COMPUTING: APPLICATIONS, CHALLENGES, AND ENABLING TECHNOLOGIES

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Tutorial Summary

In recent years, unmanned aerial system (UAS) has attracted significant attention from industry, federal agencies, and academia. Although most existing UAS applications involve a single UAS, many new civilian UAS applications are expected to desire cooperative computing capabilities of multiple UAS. Such a trend leads to opportunities for researchers to tackle rich fundamental challenges across many disciplines, such as aerospace, control, communication, networking, and computing. In this tutorial, our objective is to explore this new and cross-disciplinary area: networked airborne computing. We will address how to design and develop future generations of UAS-based networked airborne computing system, which consists of a network of smart UAS that integrates communication, control, computing and storage capabilities.

We will first discuss how existing and potential applications can be developed in the paradigm of networked airborne computing. After summarizing the requirements of these applications, we will address the challenges in system design, control, communications, networking and computing. We will then elaborate on enabling technologies, such as advanced control mechanism, long-range communication system, software-defined networking and network function virtualization, various virtualization mechanisms in computing, and mixed reality based human machine interface technology for manned-unmanned teaming. Finally, we will discuss open issues and important future directions, before concluding the tutorial.

Tutorial Outline

- 09:00 – 9:15: Introduction of the market trend, regulation and policy, and existing testbeds for networked airborne computing systems
- 09:15 – 9:45: Discussion on the new applications of networked airborne computing, including emergency response, cooperative surveillance, 3D image stitching, UAS swarm, content delivery, and airborne edge computing
- 09:45-10:15: Design challenges, open issues, and future directions for networked airborne computing on aspects such as power supply, flight control, communication, networking, and computing
- 10:15-11:45: Enabling technologies for networked airborne computing, including cooperative control, broadband and long-range communication system, programmable medium access control, software-defined networking, network function virtualization, information-centric networking, virtualization mechanisms in computing, and manned-unmanned teaming
- 11:45-12:00 Summary, discussion, and feedback

Intended Audience

- Students, researchers, and developers interested in multi-UAS development and applications, with a background in aerospace, control, communication, networking, or computing.

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