ADVANCE Distinguished Lecture Series Speaker
Dr. Ella M. Atkins

November 10, 3:00-4:00pm, Tadtman Boardroom
Reception 4:00-4:30pm

Cyberphysical Flight Planning for Nominal and Emergency Situations

Abstract: This presentation will describe fusion of traditional sensor data with new data from the Internet of Things (IoT) to provide better situational awareness to an autonomous flight planner. IoT/sensor data fusion can substantially improve real-time contingency response including emergency flight planning, and can enable a manned or unmanned aircraft to plan a route that minimizes risk based on entities on the ground as well as airborne objects and atmospheric conditions. Of particular interest is modeling and consideration of power and thermal profiles for efficient fixed-wing Unmanned Aircraft Systems (UAS) that host high-performance processing and solar energy harvesting systems that generate comparable power and thermal loads to propulsion system components. Nominal flight plans accomplish mission goals and satisfy constraints, e.g., energy balance, turbulence. Emergency landing plans are computed in real-time as needed to minimize risk to people and property on the ground as well as risk to the UAS when possible. Data sources investigated in our previous work include building, terrain, and street maps along with cell phone data. IoT data metrics include applicability, currency, availability, cost, and security. Data with potentially high value must be processed and communicated in the most efficient manner to support decision-making. The flight planner in turn must account for new IoT information through novel cost and reward metrics, performance and safety constraints, and means to deal with uncertainty and gaps in real-time data feeds. A combination of discrete (e.g., limited-horizon search, Markov Decision Process) and geometric (e.g., Dubins) methods support the spectrum of hard real-time emergency response to long-term mission optimization activities required.

Biographical Sketch:

Dr. Ella Atkins is a Professor in the Department of Aerospace Engineering at the University of Michigan, where she is director of the Autonomous Aerospace Systems (A2SYS) Lab and Associate Director of Graduate Programs for the Robotics Institute. Dr. Atkins holds B.S. and M.S. degrees in Aeronautics and Astronautics from MIT and M.S. and Ph.D. degrees in Computer Science and Engineering from the University of Michigan. She previously served on the Aerospace Engineering faculty at the University of Maryland, College Park. Dr. Atkins is past-chair of the AIAA Intelligent Systems Technical Committee, AIAA Associate Fellow, IEEE senior member, small public airport owner/operator (Shamrock Field, Brooklyn, MI), private pilot (Aircraft Single Engine Land), and holds a Part 107 UAS certificate. She served on the National Academy's Aeronautics and Space Engineering Board (ASEB) (2011-2015 term), the Institute for Defense Analysis Defense Science Studies Group (DSSG) (2012-2013), and an NRC committee to develop an autonomy research agenda for civil aviation (2013-2014). Dr. Atkins has established a long-term research program in decision-making and control to assure safe contingency management in manned and unmanned aircraft applications.