# Department of Astronautical Engineering

## Special Seminar

## Autonomy and Machine Learning in Space and Space Domain Awareness

Professor Jonathan Black
Virginia Tech

Abstract. As resident space object populations grow, and satellite propulsion capabilities improve, it is becoming increasingly challenging for space-reliant nations to maintain space situational awareness using current human-in-the-loop methods. This presentation describes several real-time adaptive approaches to autonomous sensor network management for tracking multiple maneuvering and non-maneuvering satellites with a diversely populated Space Object Surveillance and Identification network. The methods integrate suboptimal Partially Observed Markov Decision Processes (POMDPs) with covariance inflation or multiple model adaptive estimation techniques to task sensors and maintain viable orbit estimates for all targets. Like in real-world situations, the population of target satellites vastly outnumbers the available set of sensors. Robust and adaptable tasking algorithms are needed in this scenario to determine how and when sensors should be tasked. The strategies successfully track hundreds of non-maneuvering and maneuvering spacecraft using only dozens of ground and space-based sensors. The results show that multiple model adaptive estimation coupled with a multi-metric, suboptimal POMDP can effectively and efficiently task a diverse network of sensors to track multiple maneuvering spacecraft, while simultaneously monitoring a large number of non-maneuvering objects. Overall, this work demonstrates the potential for autonomous and adaptable sensor network command and control for real-world space situational awareness.

Friday, March 29, 2019 – 2:00 PM
VHE-217
Refreshments will be served at 1:45 PM