Presentation Abstracts – Concurrent Session 6

*Presenters and their associations are highlighted.

- **Ranjana Mehta**, Robin Murphy, Camille Peres
  Department of Industrial & Systems Engineering, TAMU – Cancelled due to Hurricane Dorian

  Human-Robotic Interactions (HRI) during Natural Disasters: Operator States Assessments and Improvements for Effective HRI

  Abstract:
  Increasing technological involvement in disaster response operations require a critical assessment of human-robot interaction (HRI) in these complex and unstructured environments. Disaster robots, teleoperated by humans, provide real-time remote presence for surveillance, threat detection, and search and rescue. Here, we present lessons learned from Hurricane Harvey – in which unmanned aerial systems (UAS) were used. We learned that assessing workload and fatigue levels of operators using subjective data collection instruments like the NASA-Task Load Index were not effective and relevant. Using the psychomotor vigilance test (PVT) we could reliably quantify fatigue-related decrements in operator performance, however the 10-minute standardized test was impracticable as it placed additional burden on the operators. Fatigue levels of these operators, many of whom are seasoned, were then exacerbated within few days of a mission. These findings indicated that while years of experience attending to disasters may help in effectively maneuvering flights and even situations, it is unlikely that operators can be conditioned for stress and fatigue. We recommend a review of crew rest schedules, user interface design and training policy changes to mitigate fatigue experienced by operators in the field.

- **Anjin Chang**, Junho Yeom, Jinha Jung, Lea-Der Chen, Juan Landivar
  Department of Engineering, TAMUCC

  Building Damage and Recovery Monitoring from the Harvey using Unmanned Aerial System (UAS)

  Abstract:
  Unmanned Aerial System (UAS) is getting to be the most important technique in recent days since the fine spatial and high temporal resolution data previously for disaster monitoring unobtainable from traditional remote sensing platforms. Monitoring building damage and recovery level can be the most important to show the resilience in disaster area at South Texas. This study proposed a novel method to assess building damage and recovery level from the Harvey using multi-temporal Unmanned Aerial System (UAS) images. The building height and color information were used to monitor 3-dimensional change for the individual building. One airborne data collected before the disaster and four UAS data after the Harvey in 2017 and 2019 were compared to assess building damage and recovery levels. The result showed that UAS data should be useful to understand resilience level for disaster event.

- Qingyi Wang, **Xiaofeng Nie**
  Department of Engineering Technology & Industrial Distribution, TAMU

A Stochastic Programming Model for Emergency Supply Planning Considering Traffic Congestion

Abstract:

Traffic congestion delays emergency supply after disasters, but it is seldom considered in the emergency logistics literature. To fill this gap, we propose a traffic congestion incorporated two-stage stochastic programming model that facilitates the planning of supplies pre-positioning and post-disaster transportation. The corresponding mixed-integer nonlinear program is efficiently solved with a generalized Benders decomposition algorithm. A case study on a hurricane threat in the southeastern U.S. shows the superiority of our model and provides managerial insights.

- **Yalong Pi**, Nipun Nath, Amir Behzadan

Department of Construction Science, TAMU

Artificial Intelligence for Fast Disaster Impact Information Retrieval and Mapping from Aerial Footage

Abstract:

Successful disaster mitigation, preparedness, response, and recovery heavily depends on having access to accurate disaster impact information. Aerial reconnaissance using helicopters and drones can provide fast, holistic assessment of disaster damage. Researchers in the Construction Informatics and Built Environment Research (CIBER) Lab launched project VOLAN in 2017 to use artificial intelligence to overcome challenges associated with traditional aerial data collection such as operator error, high cost, and slow processing. Project VOLAN takes advantage of publicly available aerial footage of previous hurricanes to build an annotated visual dataset and train AI models for detection of cars, people, damaged buildings, debris, vegetation, and flood. Viewpoint transformation is then applied to map these detections from 3D camera views onto 2D orthogonal views. Experiments indicate that the designed AI model can identify ground objects with >81% precision in real-time (>30 frames per second), and the viewpoint transformation technique can achieve >95% accuracy in mapping.