# 2018 ASPRS UAS Symposium
## at Commercial UAV Expo
## The Westgate, Las Vegas, NV
## October 4, 2018

Attendees of the Commercial UAV Expo are invited to join ASPRS for additional in-depth technical symposium. Registration at Commercial UAV Expo is required; the ASPRS UAS Symposium is an optional add-on event.

To register: https://xpressreg.net/register/uava1018/.

Attendees of the ASPRS UAS Symposium can register for Part 1 only, or for the entire day.

Cost
Part 1 Only: $175
Full Day: $250

COMMERCIAL UAV EXPO   expouav.com

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### INSTRUCTORS

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## Part 1: High Precision Mapping by Drones – An Introduction (8 AM – 12:15 PM)

**1. Mapping Frames of Reference (Datums) - Mostafa**
- Datum Definition (Traditional vs. Modern)
- Ellipsoid vs Geoid vs MSL
- Earth-Centered Earth-Fixed Systems
- NAD83, WGS84, ITRF, NATRF
- ITRS vs ITRF
- The Geoid: NAVD88, EGM96 vs EGM2008
- Map Projections – UTM, State Plane Mapping

**2. Errors and Statistical Measures in the Mapping Profession - Schuckman**
- Measurements and Errors
- Error Characterization
- Biases and Blunders
- Random Errors and the Gaussian Curve
- Accuracy and Precision

**3. Photogrammetry Concepts - Schuckman & Mostafa**
- Photogrammetric Sensors, platforms, and applications
- Standard Mapping Products
- Geometric Resolution
- Radiometric Resolution
- Image Georeferencing
  ◦ Aerial Triangulation
  ◦ Structure from Motion
  ◦ PPK – Assisted Aerial Triangulation
  ◦ DG – Direct Georeferencing
  ◦ ISO – Integrated Sensor Orientation
- Photogrammetric Data Accuracy Assessment

**4. Lidar Concepts - Schuckman**
- Definitions
- Lidar Sensors, platforms and applications
- Lidar-derived mapping products
- Calibration in Lidar
- Lidar data georeferencing
- Lidar accuracy assessment

**5. Real World Examples - Mostafa**
- Photogrammetric Data workflow
- Lidar data workflow
- Data processing and Analysis
- Quality Control
- Product Delivery

## Part 2: High Precision Mapping by Drones – Operations and Best Practices (1:15 PM - 5:30 PM)

**6. GNSS Introduction - Mostafa**
- GNSS Worldwide systems (GPS, GLONASS, Galileo, Beidou)
- GNSS Satellite Positioning – How does it work
- The Measurement Domain vs. Positioning domain
- GPS Error sources
- Error Modeling, elimination, and/or reduction
- GPS Achievable Accuracy using different Mechanisms
- PPK vs RTK GNSS
- Alternatives to GPS Base Stations - Examples
  ◦ CORS, OPUS, GEONET, CSRS, and ARGN

**7. Inertial Navigation - Mostafa**
- Rigid Body Motion
- Inertial Sensors
- Inertial Navigation Mechanization
- Coordinate Frames of Reference
- GNSS and Inertial Integration

**8. System Integration - Mostafa**
- System Integration for positioning, navigation, imaging, and Lidar
- Lidar vs Photogrammetry
- System integration for rapid response versus mapping
- Time Synchronization
- Calibration in Multi-Sensor Systems

**9. Best Practices – Mostafa/Stallings**
- Requirement Identification
- User Needs Assessment
- Planning Considerations
- Site setup
- Datums Implications
- Base Stations, GCP, Check points, etc
- Mission Planning
- Data Acquisition
- QA vs QC
- Pre-mission QC
- Post-mission QC
- Pre-Processing QC
- Data Processing best practice
- Post-processing QC
- Map Product Delivery