The Future of Testing and Training

- Major stages of the Product Development Cycle

| Measure Environments | Design and Analyze / Simulate Systems for Requirements | Fabricate, Assemble and Integrate Systems | Verify Performance via Testing to Environments |

- AES presentation covers the front-end vehicle environmental measurement of small unmanned systems; and..
- The end-game system testing of unmanned system stabilized platforms or other motion-sensitive equipment
Market Background

- Explosive Growth of Unmanned Systems
  - One of the few areas of defense budget actually increasing
  - Rapid proliferation of new vehicles, especially smaller, lower cost systems
- Most, if not all carry sensor systems, many of which are in stabilized gimbal
  - Meet target recognition and identification ranges
  - Work with integrated target trackers, laser designators for ordinance delivery or for guidance in weaponized UAVs
AES Background

- AES is a design services company in Austin, Texas helping companies bring a wide variety of commercial and military products to market.
- AES completed recently completed three small stabilized gimbal designs.
- We are currently working on a 4th new stabilized gimbal for AFRL through SBIR AF112-097.
  
  “Develop stabilized gimbal with precision laser (designator) pointing capability for small hand launched UAVs, and mid-sized tube launched UAVs. “

- AES discovered that there was virtually no environmental data for these small vehicles and no relatively inexpensive test equipment for simulating multiple axes of angular motion to evaluate stabilization performance.
Introduction / Description of Problem

- Paramount to the design and analysis of these stabilized imaging systems (or any sensitive subsystems / components) is an understanding of the vehicle motion / vibration environment
  - Angular motions that the gimbal is required to reject
  - Vibration that can adversely affect performance via structural response, gyro noise due to g-sensitivity, other electronics / sensors sensitive to vibration

- Unlike larger, more costly manned vehicle programs, structured efforts to instrument and gather motion / vibration data on smaller unmanned vehicles is rare

Engagement Simulation Animation

Typical Small UAV Roll, Pitch, Yaw Rates
Traditional Measurement and Test

- Vehicles typically instrumented by large company internal test group or external testing labs
  - Equipment usually not small or lightweight
  - Generally uses vehicle power and infrastructure
  - Process time consuming involving a number of test engineers to gather and reduce data

- For testing stabilized gimbals, multi-axis rate tables exist, but they:
  - Are expensive >$100k
  - Have long procurement lead times
  - Require significant facilities infrastructure
AES Sensor Package (ASP)

- Self-contained
- 2” X 3” X 5” and <3/4 lb package
- Six hour (battery) recording capability
- 6DOF Angular & Trans. - DC to 100 Hz
- GPS for location / altitude
- Magnetometer for heading
- Gyro Rates, Attitude/Heading (Roll, Pitch, Yaw)
- Small accelerometer - 10G, 2 to 1 kHz, 3 axes
- All data time-stamped
- Engineering data parsing and data reduction
AES Sensor Package (ASP)  
Simple Data Collection Process

- Easy and affordable method to gather environmental data on any vehicle platform
  - Mount sensors and package in vehicle and turn it on
  - Vehicle executes mission / operation
  - Remove equipment and reduce data

- Ability to easily piggyback on other tests

1) Install  
2) Measure  
3) Reduce Data

Sensors  
Data Logger
AES 3DOF Motion Simulator (A3MS)

- Simulates motion of unmanned vehicles
  - aerial, ground and marine vehicles
  - Small UAV, HMMWV, and patrol boat data used to establish max motion ranges
- Simulates simultaneous 3DOF motion
  - Measured time history, or
  - Spectrum / frequency-based
- UUT capacity – up to 20 lb, 10” tall, 7” dia
- Range of Motion
  - Position: ± 30°
  - Rate: ± 150° /s
  - Accel: ± 1000° /s²
- Portable – under 25 lbs, 110V AC power
- 3DOF real-time (e.g. joystick) control in development
AES 3DOF Simulator (A3MS)  
Simple Testing Process

- Excellent engineering testing tool
- Quickly evaluate stabilized platforms or other angular motion-sensitive sensors / systems
- Portability allows testing in labs and outdoor ranges – on towers / platforms to view / track targets and evaluate stabilization performance
- Operational over Mil-Spec temperature range -40° C to +65° C – can be used in environmental chamber
- Lab testing with imaging collimators

4) Generate Profile  5) Install UUT  6) Simulate
Measurement / Test Example

Helicopter UAV measurement and motion environment simulation
AES is currently delivering initial prototype units to beta customers. We are interested in discussing further sales, service or customization opportunities to meet your needs.

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