The UAS background:

- New industry, not new technology, except size
- System types
- FAA Actions
- The need for PNT
- The “numbers” are huge
- The Market is asking for this!
- VC funding is recognizing the opportunity
UAS - the big emerging market

• **Scope / Size**
  – Global market $8B-$14B annually
  – $80B in a decade!
  – US market $8B annually
  – Civil and commercial markets expanding exponentially
  – Military seeking cost-effective UAS solutions

• **Initial Target Markets**
  – Civil / Commercial
    • Oil and Gas
    • Power Infrastructure
    • Training
    • Agriculture
  – Government Agencies
  – Military (7500 US AC)
  – International Markets
Early Adopter Landscape
(the 1 yard line...)

Oil & Gas
- Exploration
- Geophysical Survey
- Drilling
- Transit / Pipeline
- Refinement
- Security

Critical Infrastructure
- Power lines
- Power plants
- Ports
- EMS
- Fire / Police / CST

Training
- FAA Test Ranges
- Universities with Aviation Degree (UAS)
- Other flight schools
- Flight Safety / initial / recurrent training companies

ENG / Film Industry
- Aerial footage
- Replace Helo
- Dash & Loiter
- Big Data
FAA Rules

- FAR 107 NPRM
  - sUAS – under 55 lbs/25KG
  - Line of sight, 500’, day VFR
- Large UAS – need SAC or TC
- AMA Rule – AC 91-57
- SAC
- COA
- 333 waivers
- UAS Blueprint/Roadmap
Inertial and Mag components

Honeywell HMC5883
Mag Compass

Invensense MPU 6000
Accel & Gyro
GPS Components - BLOS (IFR)

NexNav Micro-i

- GPS L1 C/A code Sensor card with SBAS capability (10 GPS +2 SBAS Channels)
- Compatible with WAAS, EGNOS, MSAS and GAGAN
- Integrity from TSO-C145c, such as Failure Detection Algorithm, Receiver Autonomous Integrity Monitoring (RAIM)
- Compliant with TSO-199C Traffic Awareness Beacon System (TABS)
- Lightning protection, EMI/EMC protection (CCA, LRU only)
- 1 Hz update rate
- 1’ x 1” module and 3.5”x2” CCA form factor (Available in CCA and LRU form factors, too.)
GPS Components – LOS (VFR)

- 5 Hz update rate
- 25 x 25 x 4 mm ceramic patch antenna
- LNA and SAW filter
- Rechargeable 3V lithium backup battery
- Low noise 3.3V regulator
- I2C EEPROM for configuration storage
- Power and fix indicator LEDs
- Protective case
- APM compatible 6-pin DF13 connector
- Exposed RX, TX, 5V and GND pad
- 38 x 38 x 8.5 mm total size, 16.8 grams.
Typical sUAS Avionics
Typical sUAS components

Power Section

Avionics Bays
The "System"

PNT dependent

GPS/INS/Autopilot

LTE, 3G, or Satcom datacomm to the cloud

C2 and Video Datalink for Air-Ground Communication

Ground Control Station

Wired or Wireless WWAN Network connection

Cloud based storage and handling (Public and VPN)

Fixed Wing or Rotary UAV

Sensors

LTE, 3G, or Satcom datacomm to the cloud

PNT dependent
The PNT Need: VLOS

• 500’ or lower
• Within line of sight*
• Single thread non-certified
• GPS for flight stabilization, basic routings, altitude (if not barometric)
• Magnetic Compass
• Levels of MEMS Inertial stabilization
• Primary control link – typically 2.4 or 5.8 GHZ
The PNT Need: BVLOS

- Any altitude
- Positive control beyond line of sight
- Dual thread certified (DO160/178?)
- Dual WAAS GPS for flight stabilization, basic routings, altitude, autonomous ops, RTB, internal logic
- Magnetic Compass
- Dual MEMS Inertial stabilization
- Primary control link – typically 915 Mhz or discreet
- Backup C2 link
- SAA - Traffic Awareness (Radar, cameras, ADS-B)
- Potential voice relay
- NextGen compatible avionics
PNT Actions for UAS Community

- Get involved in the WRC!
- Take action on RTCA SC-228
- Rally the trade groups (AUVSI, Small UAS Coalition, UAS Opportunity Fund)
- Meet with Congressional members
- Work with other Aviation Trade groups
- Work with (not against) FAA, ICAO, DGACs, CAAs
Thank you!