

Unmanned Aerial Vehicles (UAVs) – Emerging Users – Aviation GPS in UAVs



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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

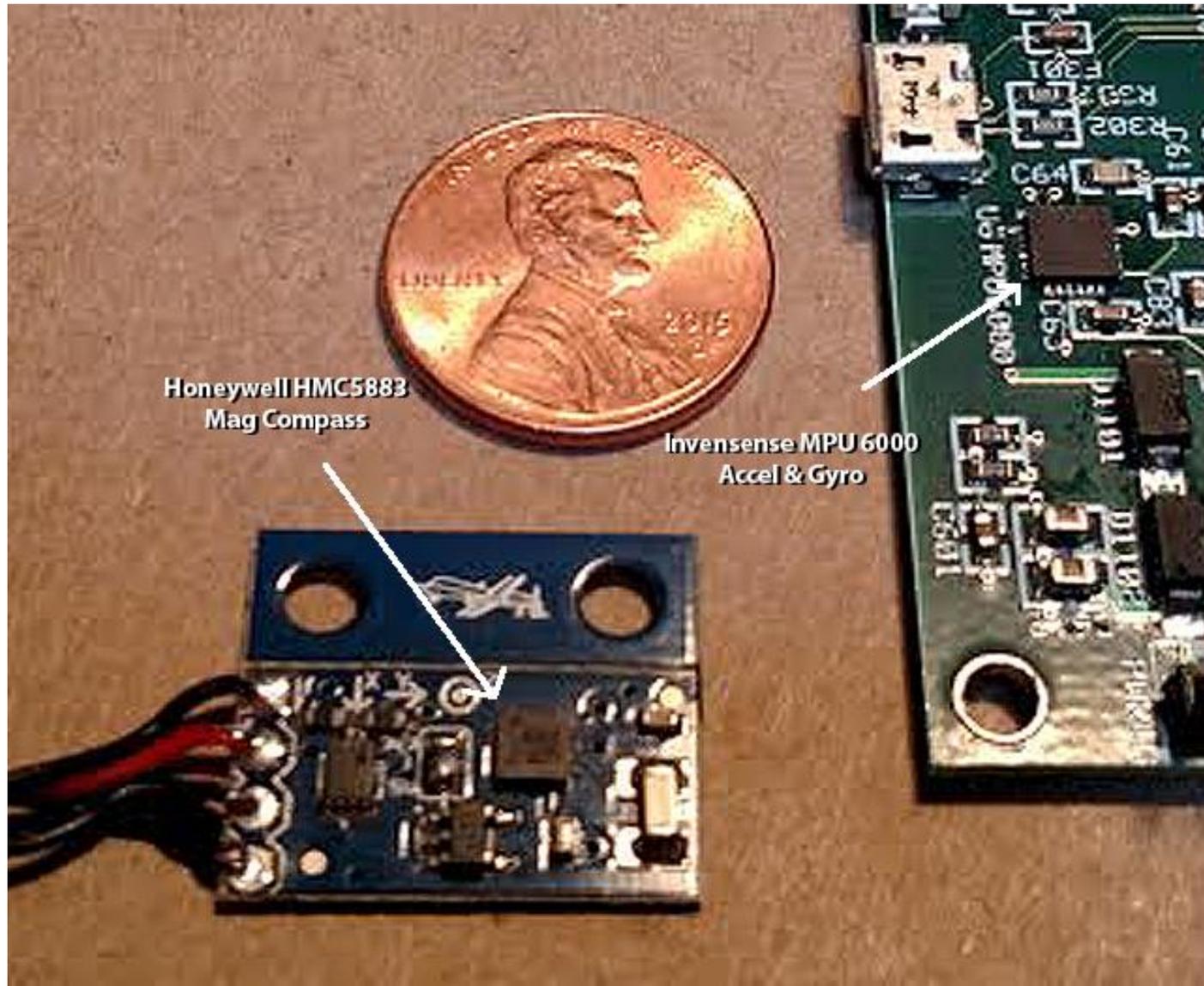


- Aerial footage
- Replace Helo
- Dash & Loiter
- Big Data

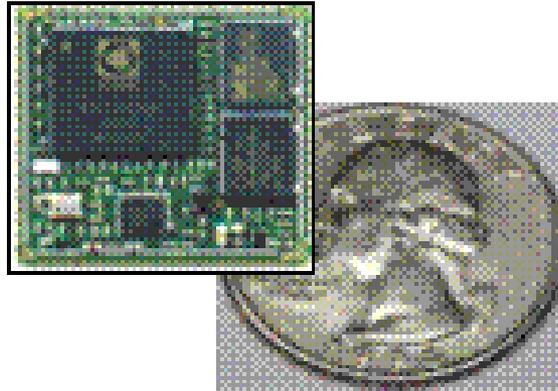
FAA Rules

- 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



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).

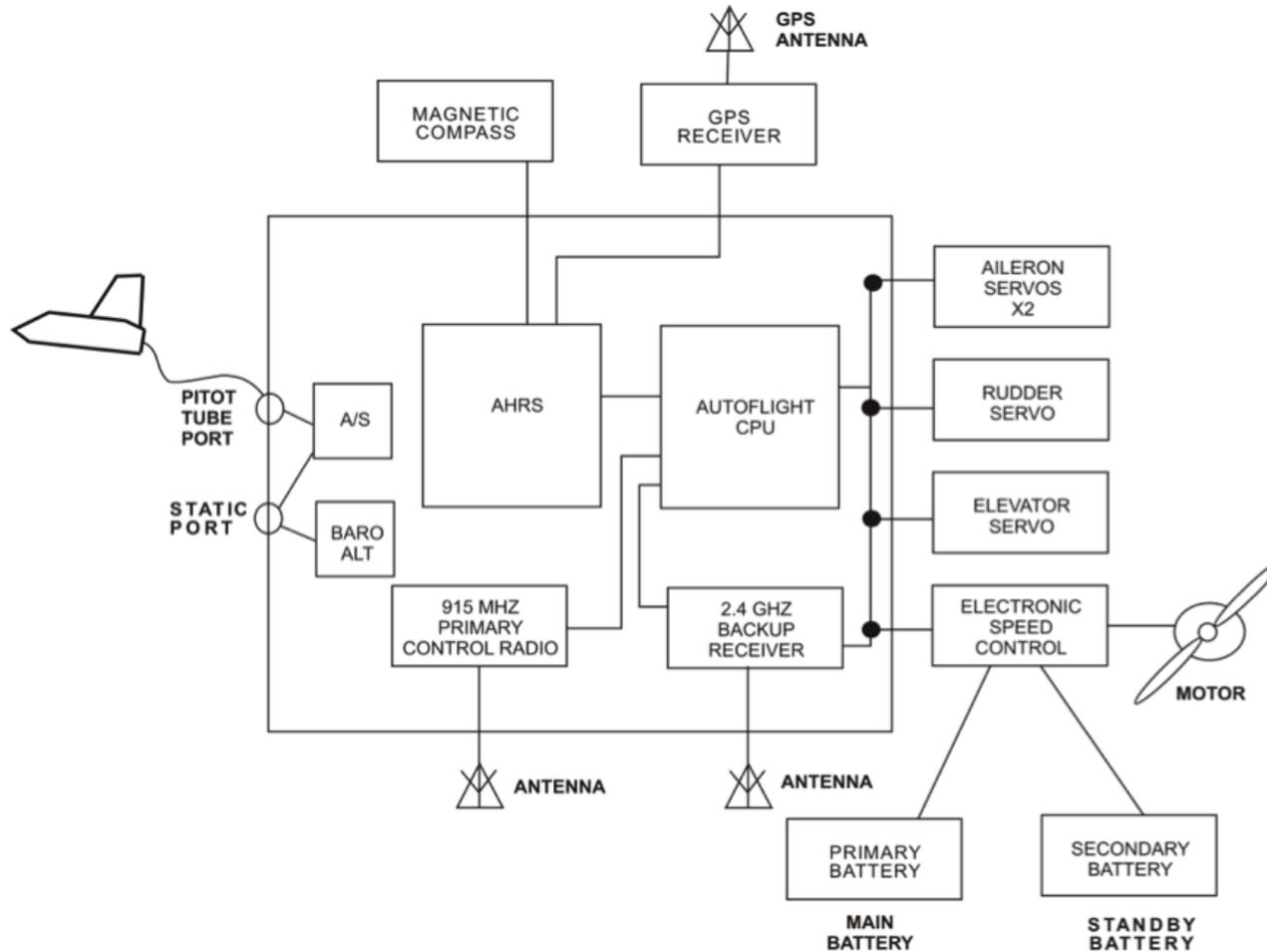
GPS Components – LOS (VFR)



u-blox NEO-7 GPS

- 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.

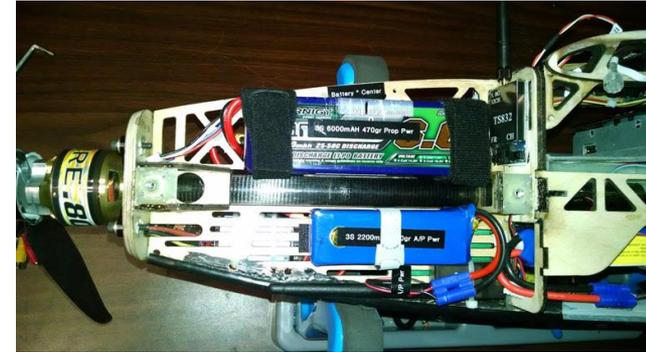
Typical sUAS Avionics



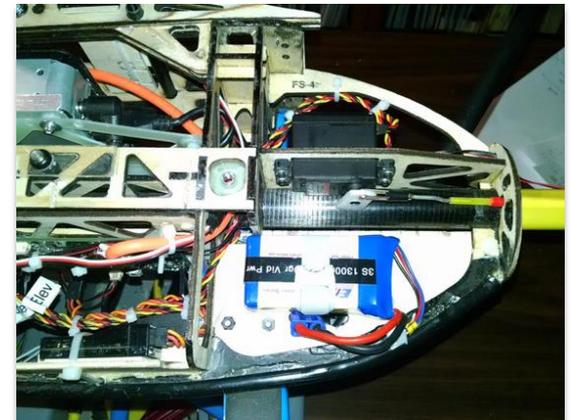
Typical sUAS components



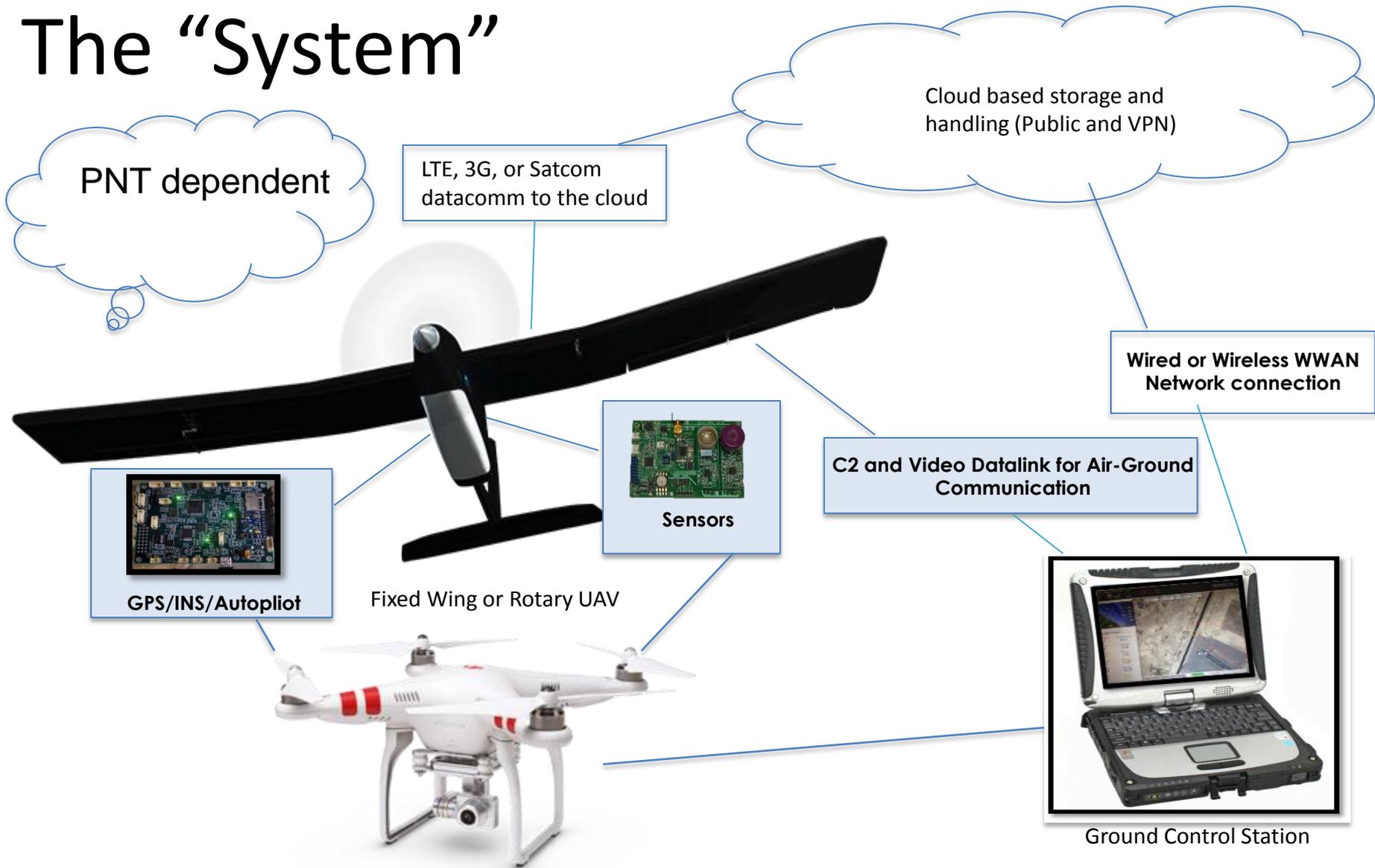
Power Section



Avionics Bays



The "System"



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!