CubeSat Communications Update

Bryan Klofas
SRI International
bryan.klofas@sri.com

CubeSat Summer Workshop
Utah State University, Logan, Utah
2 August 2014
ISILaunch-07

- 19 June 2014, Dnepr from Yasny
- UniSat-6 NanoSat
  - 2 CalPoly PPODs integrated by Tyvak (TLS-01)
  - 1 GAUSS PEPPOD
- 5 ISIS QuadPacks
  - 58U deployed, one 2U mass model wired in
ISILaunch-07: UniSat-6 CubeSats

• AntelSat (2U)
  – First Uruguayan satellite
  – 100 mW CW: 437.280 MHz
  – 1200 baud FSK: 437.575 MHz
  – 1 Mbps GFSK: 2.403 GHz
  – Amateur license

• AeroCube-6 (2x 0.5U)
  – CC1101: 915 MHz
  – Experimental license

• LEMUR-1 (3U)
  – AstroDev Lithium: 402 MHz
  – AstroDev Beryllium: 2.4 GHz
  – Experimental license

• TigriSat (3U)
  – Built by Iraqi students at GAUSS

Photos from GAUSS
ISILaunch-07: Commercial Satellites

- **Flock 1 (11x 3U)**
  - TT&C: 402 MHz
  - Image downlink: 8.2 GHz
  - Full commercial license

- **Perseus-M (2x 6U)**
  - TT&C: 402 MHz
  - AIS downlink: 26.8 GHz
  - Experimental license
ISILaunch-07: QB50 Precursor Missions

- **QB50P1 (2U)**
  - Built by ISIS
  - FUNcube-3 linear transponder
  - 9600 bps BPSK: 145.815 MHz

- **QB50P2 (2U)**
  - Built by ISIS
  - FM transponder UHF up/VHF down
  - 9600 bps BPSK: 145.880 MHz

Photo from ISIS Launch Blog
ISILaunch-07: Educational CubeSats

- **DTUSat-2 (1U)**
  - Built by Technical University of Denmark
  - CW and FSK data on 2.401 GHz, 220 mW
  - Tracking migrating birds across Europe and Africa
  - Amateur licensed

- **PolyITAN-1 (1U)**
  - National Technical University of Ukraine
  - First CubeSat from Ukraine
  - Demonstration mission
  - 1200 baud AFSK at 437.675 MHz, 600 mW
  - Amateur licensed

Photo from ISIS Launch Blog
ISILaunch-07

- Duchifat-1 (1U)
  - Herzliya Science Centre, Israel
  - APRS digipeater on 145.825 MHz
  - ISIS TRXUV transceiver
- NanoSatC-Br 1 (1U)
  - 145.865 MHz
  - Amateur license
- PACE (2U)
  - National Cheng Kung University, Taiwan
  - Attitude experiments
- POPSAT-HIP-1 (3U)
  - Singapore
  - 437.405 MHz
  - Argon cold-gas propulsion
  - Amateur license
PSLV-C23

- 30 June 2014
- Satish Dhawan Space Center, Sriharikota, India
- SPOT-7 primary

**VELOX-1 (3U)**
- Nanyang Technological University, Singapore
- 145.980 MHz CW
- ISIS TRXUV transceiver
- Amateur licensed

**VELOX-1 PIII PicoSatellite**
- 250 grams, 6 x 7 x 3 cm
Summary

- European CubeSats (QB50) are using 145 MHz for downlink
  - IARU not coordinating non-Amateur (US) CubeSats in this band
  - Spectrum already crowded, not much bandwidth

- High data downlink CubeSats have found alternate frequencies
  - Higher bands have a lot more bandwidth available
  - Relieved pressure on the 437 MHz Amateur band
  - Most educational CubeSats still using 437 MHz Amateur band

- Updates? Please contact me

- Questions?
Thank You