



CubeSat Communications Update

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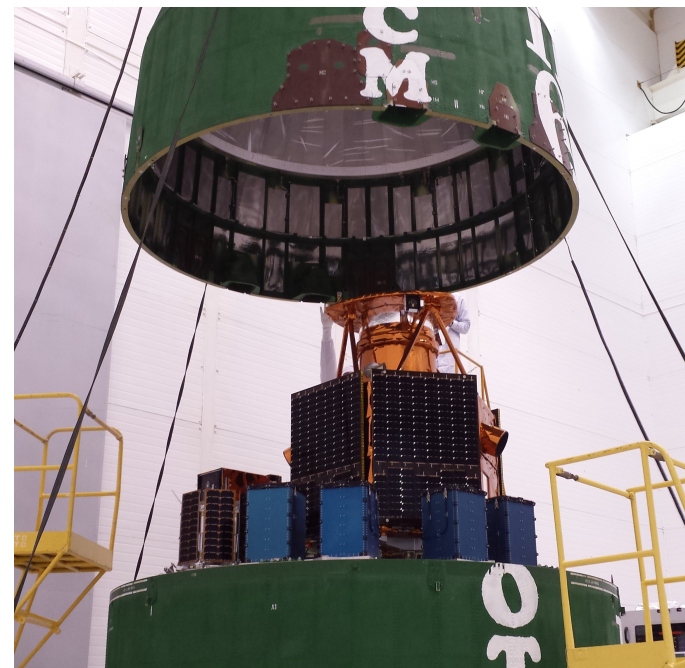
CubeSat Summer Workshop
Utah State University, Logan, Utah
2 August 2014

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



UniSat-6



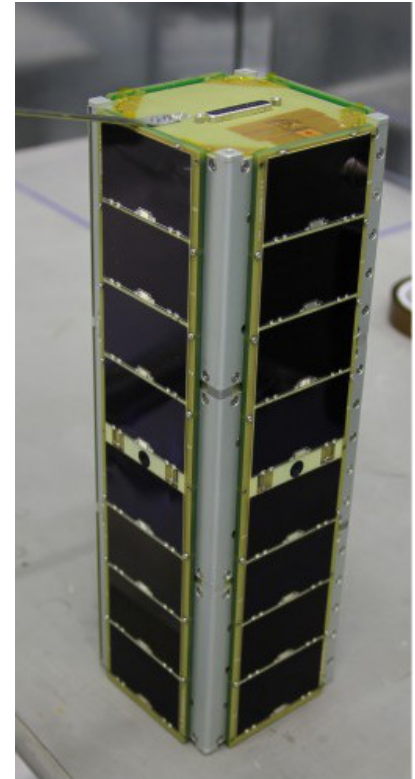
Dnepr Space Head Module

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



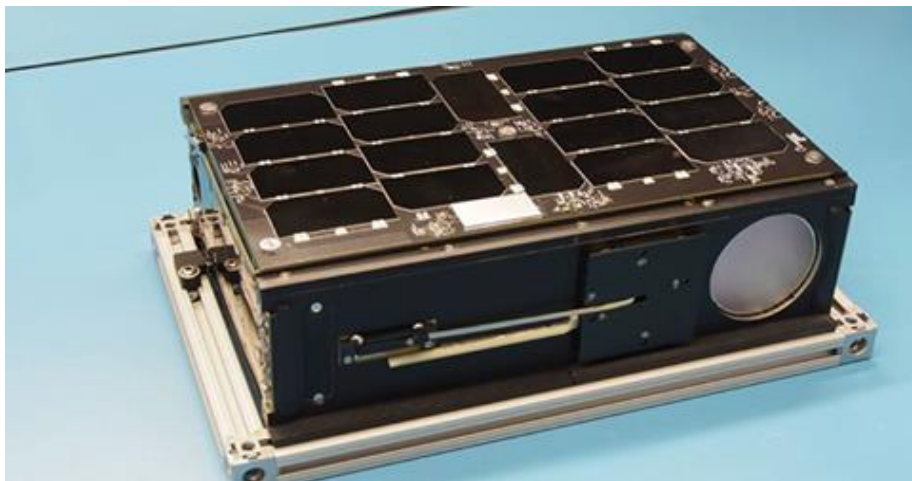
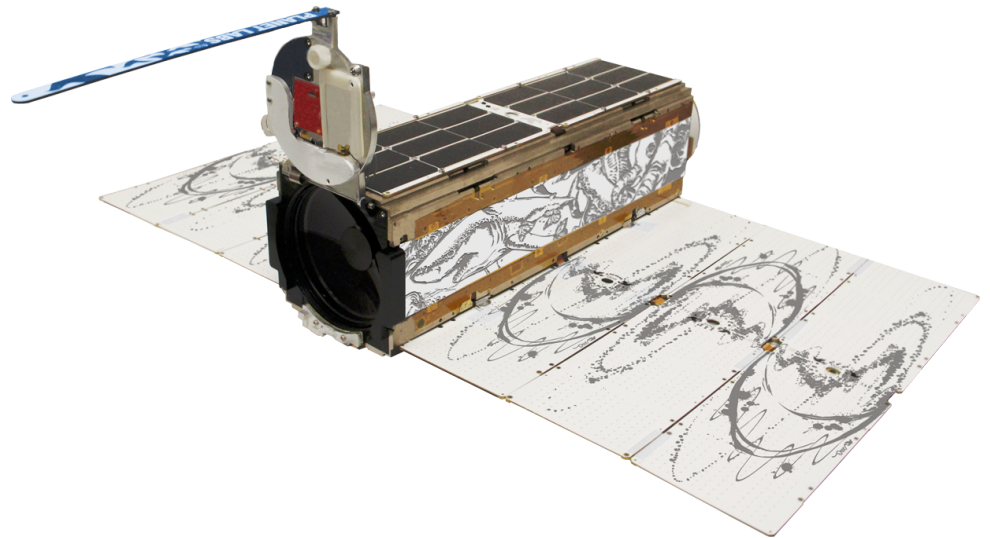
AntelSat



TigriSat

ISILaunch-07: Commercial Satellites

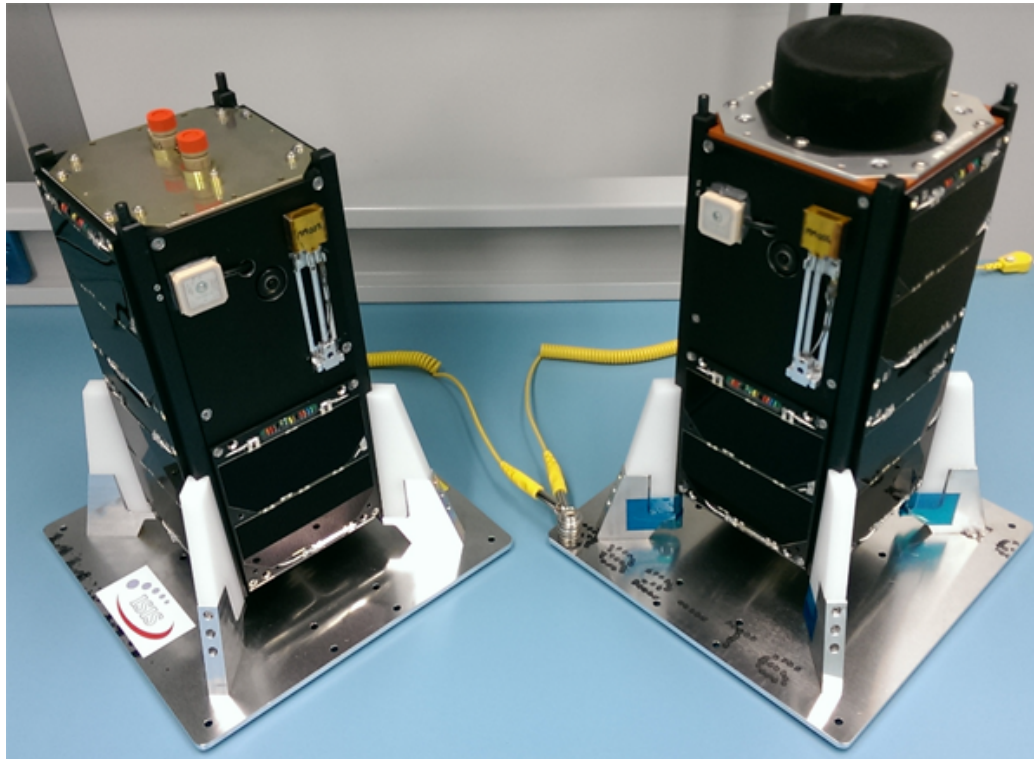
- Flock 1 (11x 3U)
 - TT&C: 402 MHz
 - Image downlink: 8.2 GHz
 - Full commercial license
- Perseus-M (2x 6U)
 - TT&C: 402 MHz
 - AIS downlink: 26.8 GHz
 - Experimental license



Perseus-M

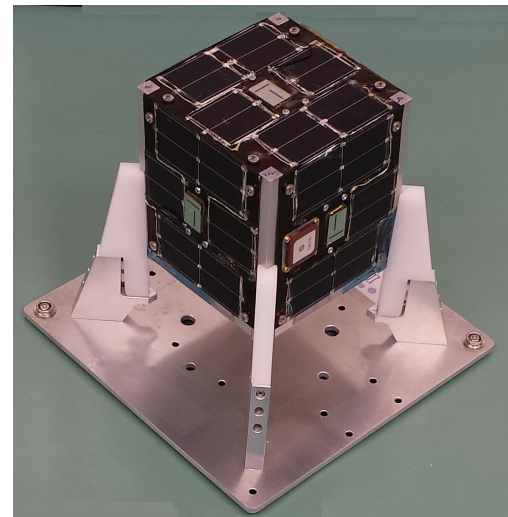
ISILaunch-07: QB50 Precursor Missions

- 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



ISILaunch-07: Educational CubeSats

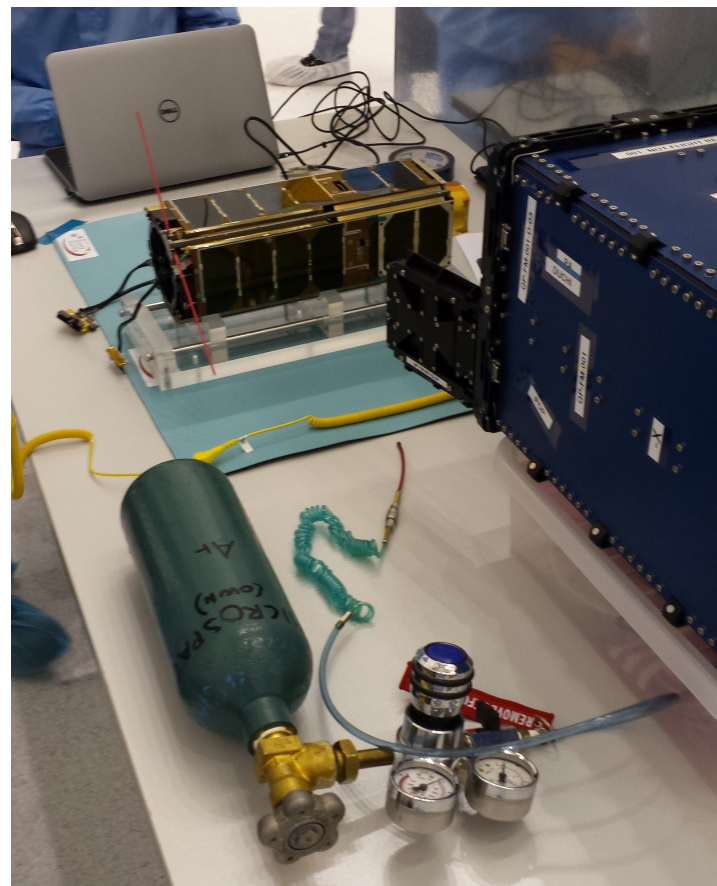
- DTUSat-2 (1U)
 - Built by Technical University of Denmark
 - CW and FSK data on 2.401 GHz, 220 mW
 - Tracking migrating birds across Europe and Africa
 - Amateur licensed
- PolyITAN-1 (1U)
 - National Technical University of Ukraine
 - First CubeSat from Ukraine
 - Demonstration mission
 - 1200 baud AFSK at 437.675 MHz , 600 mW
 - Amateur licensed



PolyITAN-1

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



POPSAT-HIP-1 Integration

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



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