## NANORACKS

### 14<sup>th</sup> Small Satellite Conference Cube Sat Deployment Services

#### • 51.6 degree inclination, 385 – 400 KM Orbit lifetime 8 – 12 months Deployment typically 1.5months after berthing

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 Each NRCSD can deploy up to 6U of CubeSats

 8 NRCSD's per airlock cycle, for a total of 48U deployment capability

• 2 Air lock cycles per mission





hoto credit: NanoRacks, LLC





3. NRCSDs installed by ISS Crew



5. Grapple by JRMS



1. NRCSDs transported in CTBs

Photo credit: MASH



4. JEM air lock depress & slide table extension

#### 6. NRCSDs positioned by JRMS

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8. JRMS return NRCSD-MPEP stack to slide table; Slide table retracts and pressurize JEM air lock



9. ISS crew un-install first 8 NRCSDs; repeat install/deploy for second set of NRCSDs



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### NanoRacks CubeSat Mission (NR-CM3)

- Orbital Sciences CRS-1
- Planet Labs Flock1A, 28 Doves
- Lithuanian Space Assoc., LitSat-1
- Vilnius University & NPO IEP, LituanicaSat-1
- Nanosatisfi, ArduSat-2
- Southern Stars, SkyCube
- University of Peru, UAPSat-1

- World's largest remote sensing constellation
- Most CubeSats launched in a single mission
- Two countries attain space faring status
- Innovative on-orbit sensor lease model
- Kickstarter



- NR-CM<sub>3</sub>
- Orbital Science CRS-1, Launch Jan 9,2014
- Air Lock Cycle 1, Feb 11-15, 2014
- Deployers 1-8 (all Planet Labs Doves)





- NR-CM<sub>3</sub>
- Orbital Science CRS-1, Launch Jan 9,2014
- Air Lock Cycle 2, Feb 25-28, 2014
- Deployers 9-14 (Planet Labs Doves)

• Deployer 15



### NanoRacks CubeSat Mission (NR-CM4)

- Orbital Sciences CRS-2
- Planet Labs Flock1B, 28 Doves
- NASA Ames, TechEdSat-4
- Taylor University, GEARRS
- MIT-Lincoln Labs, MicroMAS
- San Jose University, Lambdasat

- World's largest remote sensing constellation get's bigger!
- Innovative re-entry technology
- Concept to flight hardware 92 days
- First passive microwave radiometer in a CubeSat
- First space-based graphene experiment



### Schedule and Program Requirements

#### Scheduling (L-/+ months)

- L-9 Initial data call
- L-4, L-2 Safety Reviews
- L-1.5 Customer delivery
- L-1 NanoRacks deliver to NASA
- L+1-1.5 Deployment (typical)

#### NanoRacks Requirements

- Battery flight acceptance test
- Electrical: 3 inhibits minimum
- Customer responsible for spectrum & remote sensing licensing
- Fault-tolerance for deployables
- Non/low toxicity materials
- Secondary locking features



## Availability and Pricing

Availability

OSC Antares/Cygnus

Pricing

- \$86,000 per Unit
- Inclusive: safety, off-gas, vibe
- Volume discounts available

Payment milestones: 30% (a) contract signing, 40% Phase 3 safety review, 30% (a) deployment

### Acknowledgement



### And our Customers!

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# NANORACKS Space 4 Everyone



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