

## AMPS

- Modular, expandable space power system
- FPGA & GaNFET-based, >98% eff.
- $n_1$  400W kHz-speed MPPT input channels
- $n_2$  400W regulated output channels
- $n_3$  200W battery channels
- Robust, proven architecture with generous operating margins
- Advanced firmware with multiple safety features (WDT, OC, OT, OV, etc.)
- Real-time telemetry & control over I2C, RS422/485, USB & Ethernet interfaces
- Thermally-optimized design
- 600cc/2kg per 4-channel slice



Figure 1: Advanced Modular Power System (AMPS) -- one four-channel slice shown

## EPSM1

- 12-channel all-in-one integrated power system for CubeSats
- FPGA & GaNFET-based, >96% eff.
- 400W total kHz-speed MPPT inputs
- 300W total regulated outputs
- 240W total battery channels
- Robust, proven architecture with generous operating margins
- Advanced firmware with multiple safety features (WDT, OC, OT, OV, etc.)
- Real-time telemetry & control over I2C



Figure 2: 12-channel EPSM1 -- 6 MPT inputs, 3V3/5V0/12V/28V outputs & BAT1+BAT2

## Battery Module 2 (BM2)

- Intelligent, protected Li-Ion battery system
- Available in 2S4P (8V), 3S2P (12V) & 4S2P (16V) configurations
- 160W power (16V), 80W power (8V)
- 100Wh energy (16V & 8V)
- Fast charging & discharging (up to 10A)
- Independent primary & secondary hardware safety features, plus OV, UV, OC, OT, etc.
- Advanced firmware to automatically clear on-orbit safety faults
- Real-time telemetry & control over I2C
- Compatible with most space power systems
- Ideal energy companion to Pumpkin's AMPS & EPSM1 power systems



Figure 3: 16V, 100Wh, 160W BM2 with optional SUPERNOVA brackets attached

## Solar Panels & Arrays

- Available in a wide range of configurations: fixed, deployable & articulated
- Utilize 32.2% eff. triple-junction CIGs
- Off-the-shelf (COTS) configurations from 2W to 375W
- Custom configurations from 2W to 5kW
- LEO, GEO, GTO & lunar applications
- 7th-generation process, 100% on-orbit success

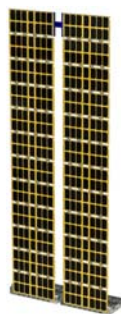


Figure 4: 375W DCSA



Figure 5: 72W MoonRanger

## Spacecraft Buses

- SUPERNOVA architecture applied to 3U, 6U & 12U CubeSats
- Class-leading software, safety, power, energy & payload accommodations
- Rust-based GUTS FSW w/independent bus and payload services running on GHz-class Linux host over TCP/IP & UDP/IP
- GraphQL requests over HTTP/MQTT
- S- & X-band radios w/AES-256 encryption over CCSDS, plus bidirectional Iridium SBD
- MPT-based thruster & multiple ACDS options
- Includes automatic discovery, on-orbit reprogramming, text-based config files
- Easy to use & customize, extensively tested



Figure 6: 12U SUPERNOVA EO/IR bus for SMC RROC1 & RROC2 missions



Figure 7: Rackmount SUPERNOVA Satellite Simulator (RS3)

Figure 8: 6U SUPERNOVA w/64W array

## Testing

- Local and remote space companies can benefit from Pumpkin's thermal and TVAC test chambers
- Fully automated and heavily instrumented, these chambers permit lights-out 24x7 testing, thereby reducing overall test campaign costs
- Multiple configurable thermal, power, RF, GNSS & communications channels
- Full Grafana dashboards for all captured telemetry (chamber and DUT) w/remote access

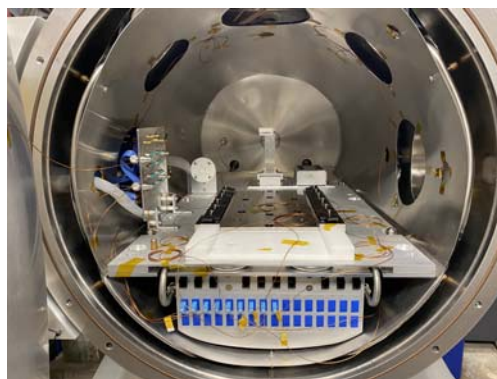


Figure 9: Pumpkin's TVAC chamber ready for 12U NASA GEVS thermal testing

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web: <http://www.pumpkinspace.com/>  
email: [info@pumpkininc.com](mailto:info@pumpkininc.com)

744 Naples Street, San Francisco, CA 94112 USA  
tel: (415) 584-6360

web: <http://www.cubesatkit.com/>  
email: [info@cubesatkit.com](mailto:info@cubesatkit.com)