HaWK Solar Array Technology
Advanced Deployable Satellite Power Solution

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Technology Overview

HaWK Series of Solar Arrays (High Watts per Kilogram)

- Portfolio of advanced deployable solar array technologies for next generation space-flight applications

- Modular, scalable, and reconfigurable to meet mission power requirements from CubeSats to 40kW systems

- Innovative stowage and deployment schemes minimize stowed volume, provide positive hold-down restraint, and enable multiple degrees of panel articulation

- Provides a redundant and simplified approach to deployable solar power technology that greatly improves system reliability
HaWK technology largely supported by SBIR funding

MMA Design solar array product portfolio continues to push the state of the art (SOA) in space power performance
Portfolio of Designs

- HaWK solar array architecture provides a building block approach allowing modularity and scalability
- Focus is on maintaining standard components for cost attractive power solutions

36W BOL @ 70°C Peak Power

72W BOL @ 70°C Peak Power

Advanced proprietary embodiments at >72W and targeting >40kW peak power

HaWK

E-HaWK

Mission Specific HaWK Configurations
HaWK modular high performance solar array

- Compatible with 3U and 6U form factors

- Deployable Solar Array Wing (3) panels
- Solar Cells (UTJ baseline) Compatible with a variety of cell embodiments
- Single solar array panel
- Power harness with customer specified connector (not shown, approximate location only)
- Snubber sheet
- Launch restraint mechanism
- Electronic melt wire release mechanism
- Gimbal (Deployment axis) Spring activated single or dual axis articulation
- (Optional) SADA Single axis drive mechanism
- Passive spring loaded panel-to-panel hinges
**HaWK Specifications**

**Power Specs**
- 36 Watts BOL @70°C Peak Power
- 130 W/kg BOL Specific power
- 99 kW/m³
- SpectroLab UTJ 28.3% at 28°C, AM0
- Discrete integrated by-pass diode

**Structural Specs**
- 1st mode >1.5 Hz deployed
- Deployment duration ($t_0$) from launch lock release to full deployment ($t_f$)
  - <1.0 second
- Solar array system mass – 276.0 grams

**Options**
- SADA 1U form factor
  - (10cm) 6.5mm thick
- Motion is +/- 180 degrees
- Sun tracking

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**Deployment sequence**

- Axis of rotation for all panels
- Axis of rotation for flip out panels

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TRL 8
HaWK - Status

- Fully qualified for the ORS² mission
- HaWK deployable solar arrays will be repurposed for the AFRL Biarri mission

ORS2 HaWK Protolflight Unit

Photo complements of COSMIAC

Biarri HaWK Protolflight Unit
E-HaWK high power solar array

- Multi-panel design for high power missions

- Deployable Solar Array Wing (3) panels
- Solar Cells (UTJ baseline) Compatible with a variety of cell embodiments
- Patented rigid substrate
- Single solar array panel (14 cells)
- Power harness with customer specified connector (not shown, approximate location only)
- Panel edge lock launch restraint mechanism
- Dual hinge, spring activated single axis deployment (Deployment axis)
- Panel-to-panel hinges with integrated torsion spring
- Electronic melt wire release mechanism

4/9/2015
E-HaWK Specifications

Power Specs
- 72 W BOL @ 70°C (3) panels per wing config.
- 144 W BOL @ 70°C (6) panels per wing config.
- 120 W/kg BOL @ 70°C Specific power
- 80-90 kW/m³
- Spectrolab UTJ 28.3% at 28°C, AM0
- Discrete integrated by-pass diode

Structural Specs
- 1st mode > 1.5Hz deployed
- Deployment duration ($t_0$) from launch lock release to full deployment ($t_f$)
  - <1.0 second
- Solar array mass – approx. 600 grams
  - Complete system with launch restraint
E-HaWK Status

- Risk reduction random vibration testing complete; criteria enveloped industry standards
- Multiple 1G deployment tests completed successfully
- Thermal Cycle testing successfully performed between 80°C and -35°C, 8 cycles with 1 hours dwells
Conclusion

- High technology readiness level
- Flight heritage 2016
- HaWK portfolio of solar array platforms is establishing state of the art technology which will enable current and future high power mission.
- Providing best-in-class power solutions with demonstrated reliability, efficient packaging, modularity, and scalable power
- Offering component commonality and innovative mechanisms aimed at providing elegant solutions at a competitive price point
- Continuous development toward new HaWK configurations to provide power up to 40kW
MMA Design: Flight hardware provider and technology incubator

- Focused on providing technologically advanced high performance space flight hardware for DoD and commercial customers
- 150 combined years of flight hardware design, analysis, fabrication, and test experience

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10,000 sq-ft of AI&T, engineering floor space

- Class 100,000 clean room
- Machine shop
- Vacuum thermal cycling
- Offload fixtures

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