Phase-2 Assignment – Team Antariksh

Electrical Power Systems Task 2
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Comparison: Commercial vs. Open-Source vs. Custom EPS

CubeSat EPS Approaches Compared Across Key Metrics
Commercial solutions offer reliability while open-source enables cost savings

Characteristic	Commercial EPS GomSpace P31u/AAC Clyde	Open-Source EPS BuildACubeSat/RGSAT	Custom Design From Scratch
Cost (USD/unit)	$4,400-5,100	$600-1,200	$800-2,500
Development Time	0 (COTS)	3-6 months	6-12 months
Flight Heritage	Extensive (100+ missions)	Growing (student projects)	None (new design)
Customization Level	Limited (preset options)	High (modular design)	Full customization
MPPT Integration	Integrated (3x channels)	Optional MPPT support	Design-dependent
Voltage Rails	3.3V, 5V, Vbat	Flexible (3.3V, 5V configurable)	Application-specific
Protection Features	OC, OV, UV, thermal	Basic (OC, thermal)	Custom implementation
Supply Chain Risk	Low (established suppliers)	Medium (COTS parts procurement)	High (component obsolescence)
Support/Documentation	Excellent (datasheets, support)	Good (GitHub, community docs)	Limited (self-documented)
TRL	TRL-9 (flight proven)	TRL-4 to 6	TRL-3 to 5
Mass (typical)	200-350g	150-250g	100-400g (variable)
Power Efficiency	93-96%	88-94%	85-92%

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Comparison of Commercial, Open-Source, and Custom EPS Solutions for CubeSat Missions

Commercial EPS (GomSpace P31u, AAC Clyde Space) offer turn-key integration with flight-proven reliability (100+ orbital deployments), integrated 3-channel MPPT, and comprehensive telemetry monitoring via I2C. Cost ($4,400–5,100) is high but eliminates design risk; development time is zero. Customization is limited to preset voltage/current options.

Open-Source EPS (BuildACubeSat, RGSAT $1K CubeSat) leverage community-shared designs with modular PMIC (Power Management ICs like LTM8062) and buck converters (LTM4675), reducing component cost to $600–1,200 and enabling flexible voltage rail configuration. Development time (3–6 months) is moderate; TRL is lower (4–6) due to limited flight heritage, but growing adoption by student teams. Documentation quality is excellent (GitHub + community support).

Custom EPS designs offer maximum flexibility but demand 6–12 months of development, detailed schematic capture, PCB layout (thermal/signal integrity), and extensive breadboarding/functional testing. Total cost ($800–2,500) depends on supplier relationships and component selection. TRL is lowest (3–5) with zero flight heritage; high obsolescence risk if key components are discontinued. Custom designs are justified only when mission requirements cannot be met by COTS/open-source solutions (e.g., ultra-low power eclipse survival, custom voltage rails).

References:

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MIST Satellite Functional Testing Report (S. Barra, KTH)
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