McKINLEY

Beyond the Limits of Lithium-ion: A Shift toward a High-Efficiency, Naturally Biodegradable Energy Paradigm

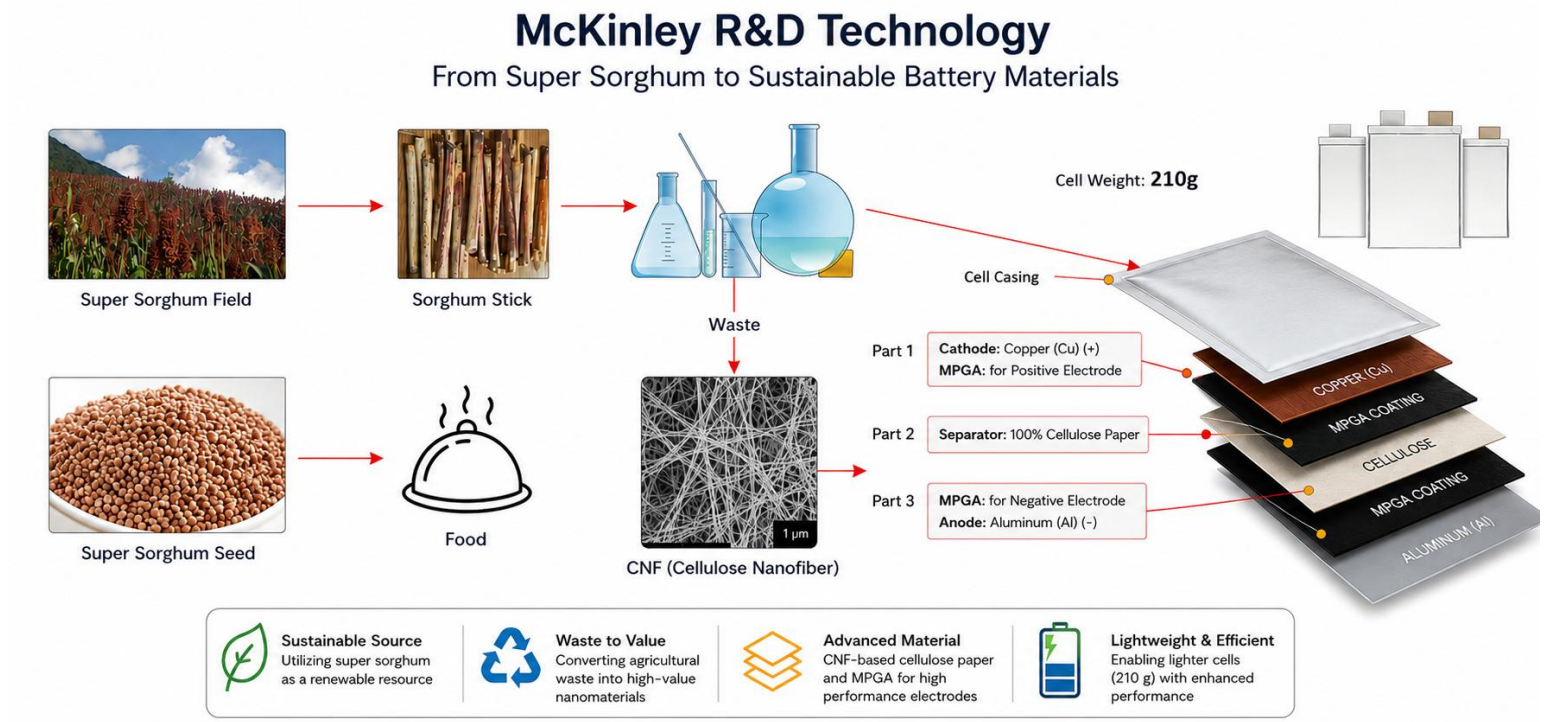
McKinley next-generation advanced technology

Originality of Technology — The Reason Why the World Cannot Catch Up to Us

1-1. What is the MPGA Battery?

The MPGA (Methylated Polyglycolic Acid) battery is a secondary battery that uses plant-based polyglycolic acid as its primary raw material. High-performance battery materials are generated by applying a methylation (modification) process to polyglycolic acid extracted from palm oil, plant-based organic matter, etc., and then combining it with an organometallic complex. The composition consists of copper (anode), aluminum (cathode), cellulose paper (separator), and MPGA complex (active material).

This technology is not a simple modification of materials, but a fundamentally new battery chemistry that breakthroughs the physical limits of existing secondary batteries through the synergy of organometallic complexes and biodegradable polymers. Development began in 2010, the first battery was completed in 2013, and after several years of actual industrial field testing, it is currently fully ready for commercialization.



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1-1. What is the MPGA Battery?

A. Characteristics of MPGA Battery

1. Does not burn at high temperatures (Melting Point: 135°C)
2. Excellent high-temperature resistance (Operates even at a maximum temperature of 85°C)
3. Explosion Risk 0%
4. Fast Charge/Discharge (Half the charging time of standard lithium batteries)
5. Long Lifespan (Can be recharged more than 40,000 times)
6. Low Environmental Load (Biodegradable, decomposes into water and carbon dioxide, harmless to humans and animals)
7. No Size Limitations during Production (1m x 10m batteries can also be manufactured)
8. Shape Deformation: Curved surface processing inside AI prosthetics is possible
9. When an automatic interchangeable self-charging system is installed in an EV, the EV can be used without separate charging
10. Charge and discharge are possible even at -20°C
11. Functions are maintained even if the battery is damaged or cut open
12. Can be used by diluting its physical properties and applying it like paint on surfaces such as walls
13. The shape of the battery can be made as desired
14. Ultra-fast battery capable of 3 hours of use with a 1-minute charge

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Global Technological Position of the MPGA Battery

Analysis of MPGA's Technological Superiority vs. Global Top 3 (Samsung, LG, SK) (As of 2026)

While global corporations are currently staking their survival on 'solid-state batteries' and 'ultra-fast charging,' MPGA is already ahead of them in various indicators. To state the conclusion first, the global technological position of the MPGA battery is World No. 1 Class. .

Comparison Item	MPGA Battery (McKinley Technology)	Global Major Corporations (A/B/C)	Technological Superiority Evaluation
Safety	0% fire risk. Thermal runaway source blocked with a melting point of 220-230°C..	While moving toward solid-state, liquid electrolyte-based systems remain the mainstream, with a focus on fire protection design (EDI, etc.).Liquid electrolyte residue poses a risk.	MPGA wins by a landslide. The material itself is a non-flammable biodegradable polymer.Explosion rate 0%
Energy density.	428 Wh/kg (per weight), 625 Wh/L (per volume).	Lithium-ion 150-300 Wh/kg. Samsung SolidStack (all-solid-state) is aiming for 800-900 Wh/L.Commercialization 2028–2035 (target).	MPGA holds the advantage. Achieved overwhelming lightweight design, particularly in terms of 'weight'. Field testing is complete, and only investment in a production plant for commercialization remains.
Charge life.	40,000+ cycles (usable for over 20 years).	Current technology is 1,500–3,000 cycles, and even the latest model in 2026 is at the 5,000 cycle level.	MPGA wins overwhelmingly. 10 to 20 times longer lifespan compared to existing batteries.
Charging speed.	Less than 8 minutes (based on buffering).	Ultra-fast technologies such as SK On SF+ have entered the 7–10 minute range (based on 80% charge).	Close race. However, MPGA holds a substantial advantage as it is the buffer standard.
Discarded. Nature-friendly.	Water and carbon dioxide. Natural decomposition.	Separate disposal facilities are required due to the leakage of heavy metals, etc., caused by the use of rare earth elements.	MPGA superiority. Eco-friendly biodegradable.
Main raw material for batteries.	Plant waste.	Rare earth elements and chemical compounds (raw material risk).	MPGA Advantage. Eco-friendly, nature conservation, infinite raw materials.

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The Gap in Technology Proven by Numbers

Comparison Item	Lead-Acid	Lithium-Ion (LFP/NMC)	Sodium-Ion	MPGA (HQ)	Technological Edge
Gravimetric Energy Density (Wh/kg)	30~50	150~300	140~160	428	Highest
Volumetric Energy Density (Wh/L)	20~50	250~600	250~375	625	Highest
Charge/Discharge Cycle Life	200~2,000	500~5,000	5,000+	45,000+	Highest (9X↑)
Battery Lifespan (Years)	8Years	5~10Years	5~10Years	20~40Years	Highest
Fast Charging Time	8~16hours	15분~8hours	15 min	8분 min	World's Best
Operating Temperature Range (Charging)	-20~50℃	-10~45℃	0~50℃	-20~120℃	Widest Range
*Explosion/Fire Risk Level	Low	High	Low	0%	Completely Risk-Free
Production Cost (per kWh)	$100~300	$151	$100~200	Under $80	Lowest Cost
Environmental Toxicity	Highly Hazardous	Hazardous	Low	100% Non-Toxic	Only Biodegradable
Weight (kg/1kWh)	20~33kg	4~7kg	6.6~7.5kg	2.3kg	World's Lightest

1. Technology (Application)

Eco-friendly and highly efficient MPGA battery

Automobile, Air-Taxi, Drone and All types of Transportations

Power Storage System and Industrial Machines

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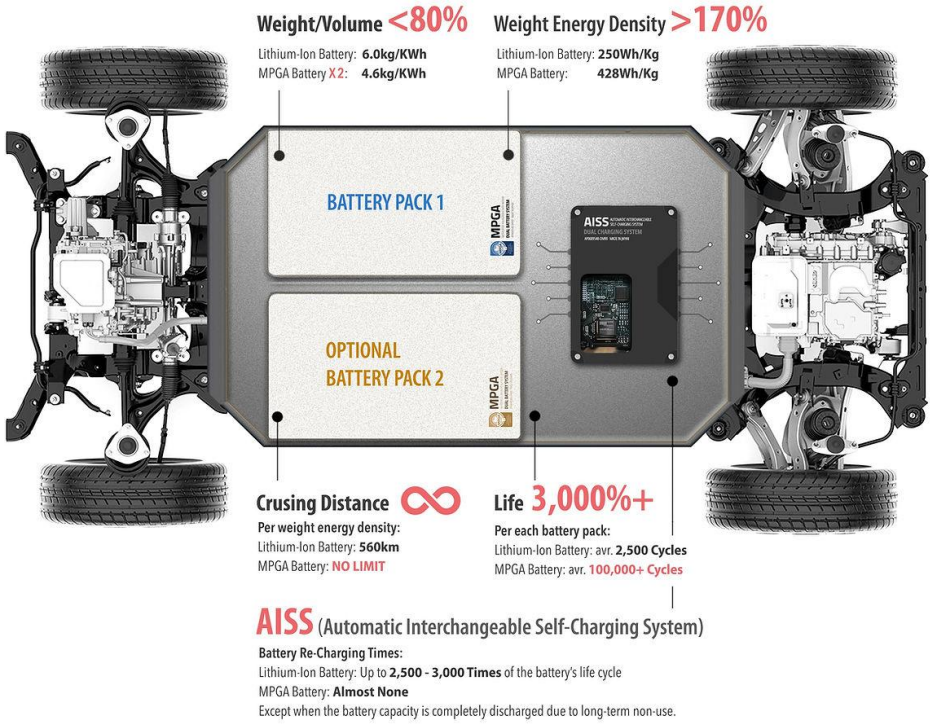
1-2. What is AISS?

The Automatic Interchangeable Self-Charging System (AISS) is a technology held by McKinley alongside the MPGA battery.
The MPGA battery provides a small, high-density energy solution that drastically saves space compared to conventional electric vehicle batteries. When optionally applied together with AISS and a dual MPGA battery configuration, users can experience a long-term usage environment with a very low frequency of charging. AISS efficiently switches between the two batteries to extend battery lifespan and optimize efficiency across various application fields. This system operates not only during standalone battery use but also when connected to a standard power supply, drawing attention as an efficient and sustainable energy alternative that significantly extends discharge time.

Compare Lithium-ion Batteries and MPGA Batteries.



AISS (Automatic Interchangeable Self-Recharging System) is the world's first system that automatically alternates the use and charging of dual MPGA battery packs.

Core Operating Principles:

- While Battery A is in use → Rapidly charges Battery B at 75x power
- When Battery A reaches 40% remaining capacity → Automatically switches to Battery B, begins charging Battery A
- 0.24 kVA Input → Achieves 18 kVA Output (75x efficiency)
- When combined with the 20-year lifespan of the MPGA battery, it realizes virtually semi-permanent, uninterrupted power supply

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"The New Origin"
WEAREUNLEASHING THE ESSENCE OF PROMISES FORABOUNDLESS FUTURE

외부 전원 공급 없이 24시간 365일 운용 가능한 드론
A drone that can operate 24 hours a day, 365 days a year without an external power supply.

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1-3. Quanthorium Battery

Currently, the global energy industry is facing two major challenges: achieving carbon neutrality and securing baseload power. Traditional nuclear power generation is powerful, but it has faced limitations in miniaturization and safety due to massive steam turbine systems and complex cooling systems. Furthermore, to overcome the risks of conventional nuclear power, large amounts of waste, extensive land footprint, and the vulnerability of centralized energy sources—where damage or shutdown from bombing or natural disasters causes power outages across many regions simultaneously—we have developed a new concept of micro-power generation technology, 'Quanthorium.' By combining the safe heat source of thorium with the innovative energy conversion capabilities of MPGA (Methylated Polyglycolic Acid) material, we present a 'Solid-state next-generation nuclear power plant with no moving parts.'

Existing SMR Power Generation Layout

대형 원전 주기기 및 격납 건물

Primary Components and Containment Structure of a Large Nuclear Power Plant

Scaled down to approximately 1/100th or less

*약 100분의 1 이하 수준으로 축소

SMR (Small Modular Reactor)

증기터빈

High-Temperature, High-Pressure Steam Turbine

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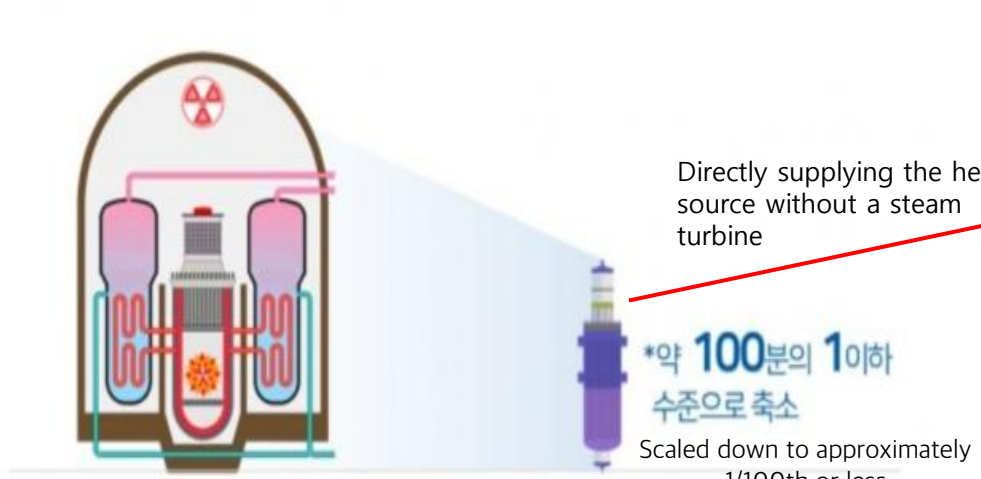
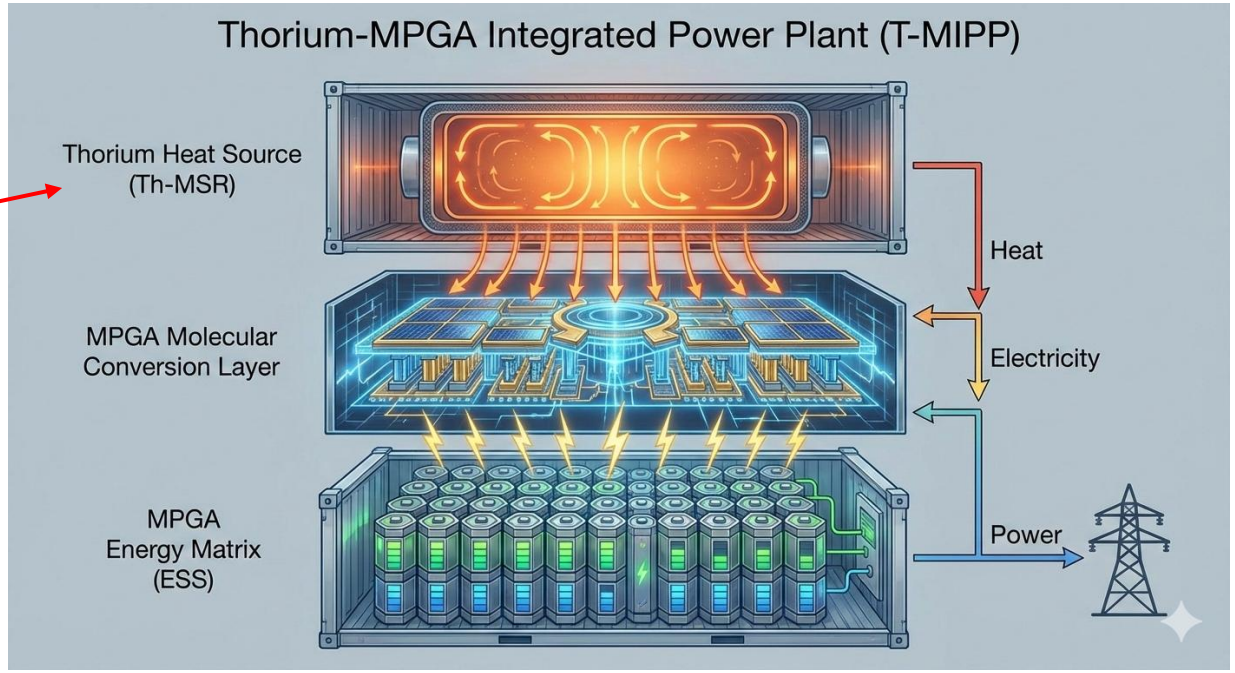
1-3. Quanthorium Battery



Primary Components and Containment Structure of a Large Nuclear Power Plant

Directly supplying the heat source without a steam turbine

Scaled down to approximately 1/100th or less



Quanthorium Battery is both a generator and an ESS

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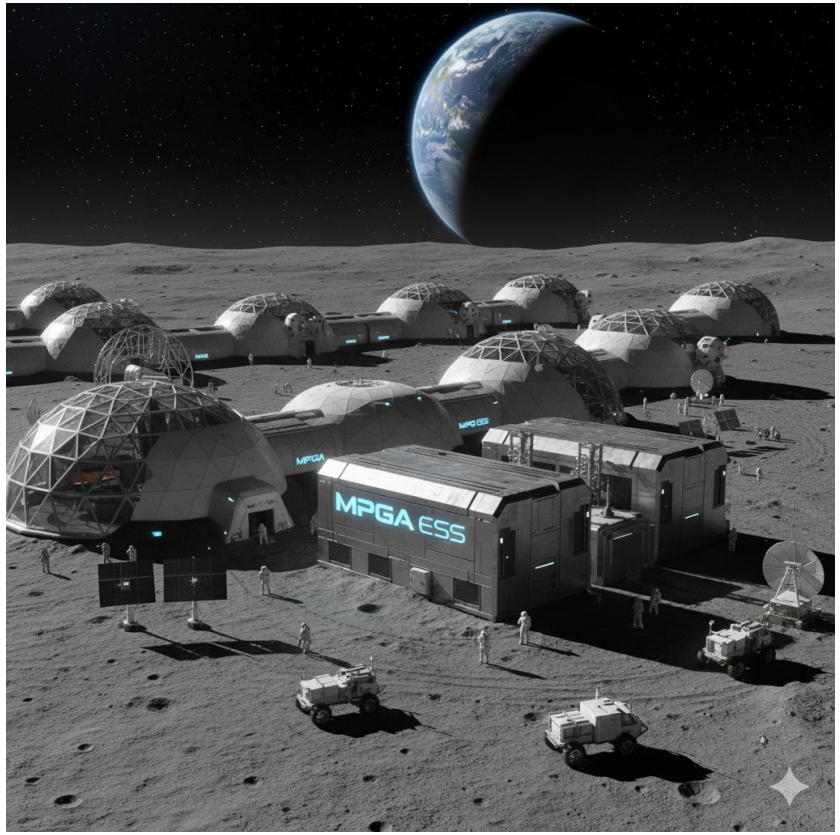
1-3. Application Fields of the Quanthorium Battery

Applicable to various industrial sectors as steam turbine-free power generation + ESS



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1-3. Space & Defense Battery

Currently, the global space and defense industries are facing two massive turning points: **"energy densification"** and **"reliability in extreme environments."** As of 2026, the global aerospace market has grown to approximately $650 billion (approx. KRW 880 trillion), and the defense market has also formed a massive market exceeding **$1.2 trillion (approx. KRW 1,600 trillion)** due to the expansion of unmanned systems and tactical robotics.

The key driver of this rapid market expansion is the power source, namely battery technology. However, Lithium-ion (Li-ion) batteries, which are currently used as the global standard by NASA and others, are facing physical limitations such as low energy density, temperature sensitivity, and short lifespans. Especially in Mars exploration, lunar base construction (Artemis Project), and Low Earth Orbit (LEO) satellite constellation operations, existing battery systems account for a significant portion of the launch weight, causing a chronic bottleneck that hinders overall mission efficiency.
Accordingly, this report proposes the strategic adoption of the next-generation solid-state technology, the MPGA (Methylated Polyglycolic Acid) battery, which is being promoted by McKinley Investment. MPGA technology possesses innovative performance, delivering an energy density of over 600 Wh/kg that overwhelmingly surpasses the limits of traditional Lithium-ion, a semi-permanent lifespan of over 40,000 cycles, and instant operation across extreme ranges of -20°C to 200°C without requiring a separate heater.

A. Space & Aerospace Market Total Market Size: Valued at approximately $652.7 billion (approx. KRW 880 trillion) in 2026, and is expected to grow to approximately $1.14 trillion (approx. KRW 1,500 trillion) by 2034. Space Battery Market: Valued at approximately $4.68 billion (approx. KRW 6.3 trillion) as of 2026, growing at over 7.5% annually. Key Trend: Launches of Low Earth Orbit (LEO) satellite constellations have increased by 35%, driving an explosive demand for "lightweight and long-lasting" batteries.

B. Defense & Security Market Total Market Size: Expected to reach approximately **$918.0 billion (approx. KRW 1,240 trillion)** in 2026, growing at an average annual rate of 8.4%. Defense Battery Demand: Due to the electrification of Unmanned Aerial Vehicles (UAVs), wearable combat systems, and ground robotics, the high-safety solid-state battery market is projected to expand to more than 10 times its current size by 2032.

Battery Comparison

Item	NASA/ISS Standard (Li-ion)	Next-Gen Research (Li-S / Solid-State)	McKinley MPGA Battery
Energy Density	250 Wh/kg	400 ~ 500 Wh/kg	600+ Wh/kg
Full Charge Tim	1 ~ 2 houres	30min ~ 1houres	6min (Ultra-fast)
Lifespan (Cycle)	5,000 ~ 10,000 cycles	Less than 1,000 cycles	40,000 +cycles
Temperature Operability	Above 0°C (Heater required) Thermal runaway possible above 60°C Recommended temperature: 20–25°C	Limited	-20°C–120°C (Heaterless charge/discharge) Melting point 200°C (No thermal runaway) Recommended temperature: -20°C–100°C
Economic Value	Off-the-shelf parts (Low Margin)	Research phase	Market game changer (High Margin)

Essential Additional Elements for Space-Grade Transition
(A situation of minor concern/constraint for the MPGA battery)
Radiation Hardening (Rad-Hard): Radiation shielding packaging to protect BMS circuitry from Galactic Cosmic Rays (GCR).
Vacuum Hermeticity: Zero Outgassing design under space vacuum conditions.
Shock Absorption Structure: Laminated structure locking technology to withstand extreme vibration during launch.

Refer to Current Space Battery System (Visual Reference)

Currently Used Model (Li-ion/Ni-H2)	MPGA Applied Model (Concept)
	
Bunches dozens of batteries together using a heavy housing	Volume reduced to compared to existing batteries due to high-density characteristics, heater eliminated
Features: Complex cooling/heating loops are mandatory	**Features:** Simple structure, self-heat dissipation design possible (Operates at and has a melting point of)

1. Technology Introduction

Conclusion: Strategic Suggestions

MPGA (Methylated Polyglycolic Acid) batteries go beyond mere commercial products, possessing all the 'dream specifications' craved by NASA and the global defense market.

By prioritizing South Korea and the United States as production bases and R&D centers, a two-track strategy becomes possible:

• In South Korea, preoccupying the defense and Asian satellite markets, and

• In the United States, establishing a foothold as a core supply chain for NASA, private space companies (such as SpaceX), and the US Department of Defense.

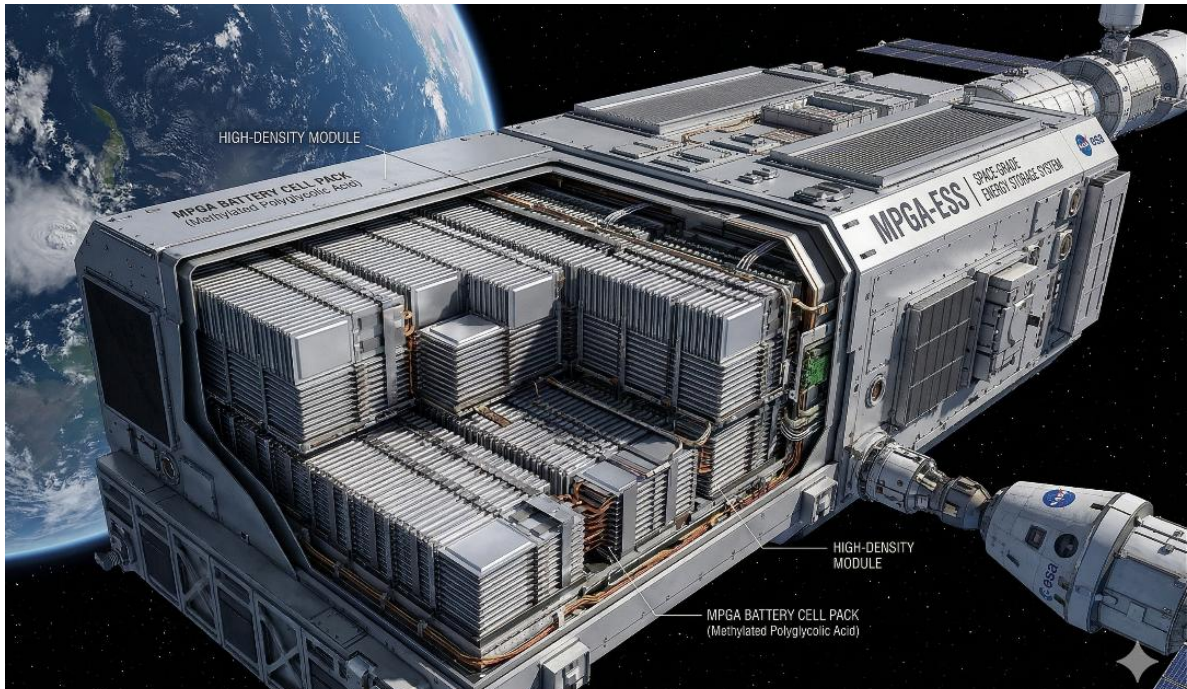
Next Steps:

Phase 1: Conduct space environment simulation (vacuum, radiation) testing at the South Korean research center.

Phase 2: Manufacture small satellite (CubeSat) prototypes matching NASA standards at the US factory.

Phase 3: Perform actual Orbital Flight Testing through partnerships with private space companies.

A marketing slogan such as "Batteries used in space supplied to all industries, from earphone batteries onwards" is also possible.



MPGA Battery Application Industry Sample

"The most reliable way to predict the future is to design that future ourselves."

Our dual-hub strategy, which bridges Korea's technological prowess with the marketability of the United States, will now become an irreversible and massive trend. Where there is certainty of growth, we will be there with the finest partner.

Please join us at the glorious beginning as a protagonist of the global energy paradigm.