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U.S. Army Partners with Georgia Tech to Revolutionize Off-Grid Power Through Aluminum-Hydrogen Conversion

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The U.S. Army Research Office has awarded a substantial $20 million grant to Georgia Tech and its collaborative partners to advance a multi-year research initiative focused on transforming readily available aluminum scrap into a scalable, on-demand, and off-grid hydrogen energy source. This ambitious project aims to significantly enhance energy independence for military operations and could deliver transformative power solutions for rural communities.

Aluminum scrap, a ubiquitous waste material on military bases and aircraft carriers globally, possesses inherent properties that allow it to react with water, including wastewater and floodwater, to produce hydrogen gas, power, and thermal energy. The core objective of this research is to develop efficient and cost-effective manufacturing methods to harness this reaction for clean hydrogen production.

“If aluminum can be efficiently upcycled into stored energy, it could be a game-changer,” stated Scott McWhorter, Lead for Federal Initiatives at Georgia Tech’s Strategic Energy Institute. This sentiment is echoed by Aaron Stebner, Professor and Eugene C. Gwaltney Jr. Chair in Manufacturing at Georgia Tech’s George W. Woodruff School of Mechanical Engineering and professor in the School of Materials Science and Engineering, who will oversee the project. Stebner highlights the strategic importance for military bases to reduce their reliance on external electrical grids.

While the fundamental technology for recycling aluminum to produce hydrogen was patented by the Army Research Lab several years ago, current manufacturing methods are energy-intensive and cost-prohibitive.

The Georgia Tech-led consortium will address these limitations by researching alternative manufacturing processes, developing automated methods for safe aluminum production and storage, and optimizing these processes through advanced digital twin technologies. The team is exploring innovative, small, modular technologies that could enable convenient, onsite energy generation, potentially powered by renewable sources such as solar panels for 24/7 operation.

The comprehensive research team includes experts from Georgia Tech, the Georgia Tech Research Institute, Fort Valley State University, the 21st Century Partnership, MatSys, and Drexel University.

Beyond military applications, the project holds significant promise for sustainable impact. Upon successful development of the manufacturing techniques, the team plans to demonstrate their efficacy by generating power for rural communities in Georgia. This validation would underscore the technology's viability for diverse off-grid scenarios, particularly in regions prone to energy disruptions from natural disasters.

"From a sustainability perspective, any time you can take something that's already waste — like scrap aluminum and wastewater — and turn it into a high-value product that can be used to power communities, that is a huge win," Stebner concluded, emphasizing the project's dual benefit of waste utilization and clean energy generation.