

# GRIDSTAR® FLOW MEDIA KIT

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# GRIDSTAR® FLOW OVERVIEW

## OUR STORY

Headquartered in Bethesda, Maryland, Lockheed Martin Corporation is a global security and aerospace company that has invested in resilient, smart energy technologies for over 86 years. Leveraging decades of engineering expertise and technology from military space programs, navy nuclear controls, C-130 propellers, the Space Shuttle, systems integration and advanced manufacturing has enabled Lockheed Martin to make major advances in the energy storage business.

## THE MISSION

Amidst a clean energy evolution, electric grids are undergoing unprecedented disruption. Storage has a vital role to play in the rise of renewables, but the current dominant technologies in use today cannot sufficiently provide the durable, flexible and distributed energy storage required to sustain power for extended periods of time. To realize the full potential of clean energy, Lockheed Martin has developed GridStar Flow: an innovative redox flow battery solution designed for long-duration, large-capacity energy storage applications.

Some of the key capabilities include:

- **Durability:** The patented technology is developed using innovative chemistry based on coordination chemistry that enables GridStar Flow to overcome limitations of existing technologies and provide capabilities that meet long-duration storage requirements. Enabling energy resilience, the battery is optimized to provide six or more hours of flexible discharge and achieve 100% depth-of-discharge over 20 years. Because of these characteristics, GridStar Flow has the potential to protect grids against anticipated and unforeseen long-term outages.
- **Flexibility:** GridStar Flow can address multiple and a broad range of applications. Unlike current energy storage technology, GridStar Flow does not experience significant calendar degradation and is not damaged by changes in duty cycles, high cycling frequency, full discharge, or long periods at high states of charge, enabling GridStar Flow to offer flexible, critical mission support on short notice and sustain resilience requirements during grid outages.

# GRIDSTAR® FLOW OVERVIEW

- **Resilience:** Pairing renewable power and safe, economical, long-duration energy storage, with enough capacity to support loads through periods of renewable downtime, will minimize or eliminate dependence on fossil generation, leading to greater resilience, lower emissions and a more sustainable future.

The mission of Lockheed Martin is to provide 21<sup>st</sup> century solutions to our customers' most complex challenges while protecting the environment, strengthening communities and propelling responsible growth. Setting a new industry standard, GridStar Flow offers affordable, reliable, and widespread use of renewable energy at a competitive total cost of ownership.

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# MEET GRIDSTAR® FLOW'S LEAD EXPERTS



## TOM JARVI

- General Manager
- 12 years with GridStar Flow
- PhD, Chemical Engineering
- 24 years commercializing electrochemical systems



## MIKE BUFANO

- Head of Engineering
- 10 years with GridStar Flow
- MS, Mechanical Engineering
- 27 years of new product development
- 18 US patents

# MEET GRIDSTAR® FLOW'S LEAD EXPERTS



## STEVEN REECE

- Head of Chemistry
- 13 years with GridStar Flow



## JENNIFER BURKE

- Head of Energy Storage Market Strategy
- 6 Years with GridStar Flow
- MBA, MIT Sloan
- 20+ years advancing innovative energy and climate tech companies and products



# GSF FAST FACTS



## GridStar® Flow



Lockheed Martin has invested in resilient and smart energy technologies for over 86 years. Transformation to a renewable, distributed, secure electricity system requires durable, flexible, energy storage to store and discharge power for extended periods of time. That's why we developed GridStar Flow. Engineered for the future of energy, GridStar Flow is an innovative redox flow battery designed with patented technology that offers a robust and flexible solution for long-duration energy storage.

### GridStar Flow Capabilities

GridStar Flow provides long-duration energy storage with superior durability and flexibility to advance resilient and clean energy goals.



#### Durability

100% depth-of-discharge with minimal degradation across applications and a design life of 20 years with normal maintenance



#### Optionality

Addresses a wide range of applications behind- and front-of-the-meter and can quickly switch between applications



#### Stability

Ensures a nonflammable, noncorrosive and stable clean energy solution through the use of aqueous electrolytes



#### Long Duration

Optimized for 6-12 hours of flexible discharge



#### Affordability

Offers competitive total cost of ownership over the design life



#### Siteability

Can be flexibly and safely sited in a variety of environments



#### Future Proof

Freedom to operate in future differently than originally planned, allowing customers to address evolving markets

### Applications



- Renewable generation bulk shifting
- Large-scale transmission & distribution deferral
- Microgrids for sustainability and resilience

### Sustainability



- Zero carbon emissions when paired with renewables
- Enables energy independence
- Made with mildly alkaline, aqueous electrolytes

### Economic Impact



55 employees  
100 vendors



- Key parts and materials sourced from domestic suppliers
- Manufactured primarily in the U.S.

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# ANDOVER FAST FACTS



## Andover Operations

Lockheed Martin's 95,000-square-foot facility in Andover is the official home and single site for the development, testing and production of GridStar® Flow. Bringing together employees across roles in Engineering, Technology, Program Management and Operations, this cutting-edge facility houses the program's New Product Introduction manufacturing site, all development laboratories and office space to support program collaboration and integration.



Works with  
100 Total  
Vendors

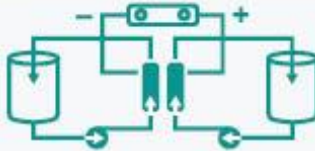


Headquartered in  
Andover, MA



Supports  
37 Local  
Vendors

## Mission Area



GridStar® Flow is a redox flow battery based on the principles of coordination chemistry, offering a new electrochemistry consisting of engineered electrolytes made from earth-abundant materials. The first commercial version of GridStar Flow (S/N01) is installed at the Andover facility. This prototype will be tested to determine system performance and will form the basis for future customer-sited projects.

## Facilities Breakdown



885 kW  
Combined Storage  
Test Asset Capacity



### Andover Houses



Manufactures  
Direct Current  
Power Modules

1 Chemistry Lab  
2 Materials Research & Testing Labs  
1 Electrical Engineering Lab

2 Mechanical Engineering Labs  
3 Stack Assembly & Disassembly Labs  
3 Battery System Testing Labs

## People and Footprint



61  
Total Headcount



70%  
With Technical Degrees

49%  
With Advanced Degrees



60 Patents  
11 Pending Applications  
6 New Applications in Progress



60% Engineers  
5% Operations  
15% Scientists & Chemists  
10% Program & Product Management  
10% Business Development

## Sustainability Practices



- Entire building was remodeled to be energy efficient and green
- Installed all LED lighting throughout the facility
- Heat Recovery System installed on Lab Fume Hood System
- Working with National Grid to install EV Charging station on site





## Lockheed Martin To Build First Long-Duration Energy Storage System for U.S. Army

[Read More](#)

### Energy Storage News

*By Andy Colthorpe*

[Lockheed Martin putting long-duration flow battery at US Army's Fort Carson](#)

### Popular Science

*By Rob Verger*

[How the massive 'flow battery' coming to an Army facility in Colorado will work](#)

### Lockheed Martin News Release



[Lockheed Martin And TC Energy Partner To Advance Alberta Sustainability And Decarbonization Efforts](#)

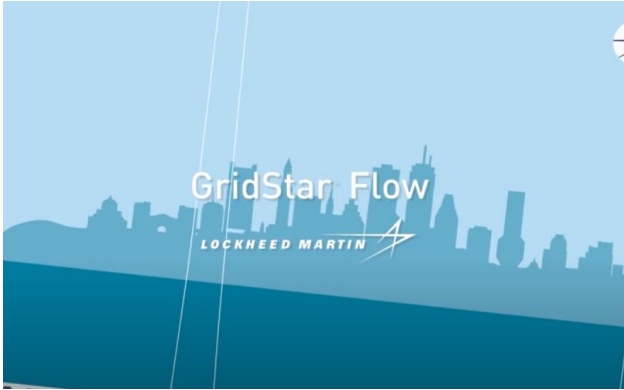


[Testing 1, 2, 3: Lockheed Martin Installs its First Commercial Version of GridStar Flow](#)



[Lockheed Martin's Clean Energy Scientists Have a New Home](#)

# VIDEOS



How GridStar Flow Works



Andover B-Roll



GridStar Flow Animated Video



Fort Carson GridStar Flow Media Brief

# VISUAL ASSETS



GridStar Flow Rendering – Ariel Shot



GridStar Flow Rendering – Side View



GridStar Flow Rendering – Front View



Andover Energy Exterior



# FORT CARSON PROJECT SUMMARY

## GridStar® FLOW

GridStar Flow Long-Duration Energy Storage Demonstration  
at US Army's Fort Carson

DRIVING FUTURE MILITARY GRID RESILIENCE SOLUTIONS



### System Size & Technology

1 MWh GridStar Flow energy storage system expected to have a discharge duration of 10 hours

### Applications

High operational flexibility supports a broad range of grid and resilience applications to maximize asset return and support critical mission loads

### Location

Colorado Springs, Colorado

### Site

Fort Carson

### Project Development, Construction & Operation

Lockheed Martin is designing and installing the GridStar Flow unit and support operations and testing for a period of two years

### System Benefits

- 100% depth-of-discharge
- Minimal degradation across multiple applications
- Design life of 20 years
- Optimized for 10 hours of flexible discharge
- Insights gained support future long-duration storage deployment across all DoD services and installations

### Project Summary

Lockheed Martin is developing the first megawatt-scale GridStar Flow long-duration energy storage system for the U.S. Department of Defense (DoD) at Fort Carson in Colorado Springs, Colorado.

Lockheed Martin's first customer-sited GridStar Flow system is intended as a demonstration unit for the Army and ERDC-CERL. This system will be tested against protocols that simulate microgrid and renewable integration to ensure critical missions can continue in the event of a long-term power outage. It is expected to have a discharge duration of 10 hours.

Insights gained from this pilot project support the deployment of future long-duration storage across all DoD services and installations.

### About GridStar Flow

GridStar Flow is an innovative redox flow battery designed for long-duration, large-capacity energy storage applications. The patented technology is based on the principles of coordination chemistry, offering a new electrochemistry consisting of engineered electrolytes made from earth-abundant materials. These properties enable GridStar Flow to deliver a robust and flexible long-duration, clean energy storage solution, with a competitive total cost of ownership.

GridStar Flow delivers mission critical energy resilience by making long discharge durations (10+ hours) economically viable. Because flow battery technology is not bound by cycling, depth of discharge, or state of charge limitations and does not experience capacity degradation over time, GridStar Flow can address a broad range of applications, deliver higher returns and savings during normal grid operations, and provide flexible critical mission support on short notice to support resilience requirements in the event of an outage.

Electric grids are undergoing unprecedented change as intermittent, non-dispatchable renewables continue to displace traditional power generation sources. Long-duration energy storage that can store and discharge for more than four hours is the key to reliably, economically, and sustainably balancing the grid.

In 2020, we opened our 95,000 square-foot facility located in Andover, Mass., which is now the official home of GridStar Flow, where the development, testing and production have been consolidated.

For additional information, visit our website: [www.lockheedmartin.com/gridstarflow](http://www.lockheedmartin.com/gridstarflow)

**"Electric grids are undergoing unprecedented change. Energy requirements are shifting as we consider renewable resources coupled with utility-scale, long-duration storage options. Solutions to increase resiliency and self-sufficiency are crucial to economically and sustainably supporting DoD operations."**

- Dr. Andrew J. Nelson, Director, CERL

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