



**Trust EaglePicher  
When it Matters Most**

**Company  
Capabilities  
and Overview**

**EAGLEPICHER**<sup>+</sup>  
TECHNOLOGIES



# Delivering Tomorrow's Technology... Today



# Rich Heritage Technology Leadership

Trust EaglePicher® When it Matters Most

EaglePicher Technologies offers the broadest range of electrochemistries available for high-tech applications in the defense, space, aviation, medical and commercial industries. U.S. owned and operated, EaglePicher has been a leader in battery technology for nearly a century.



**Trusted Power** EaglePicher supplies power for the majority of U.S. military's missile and munitions systems

**Reliable Power** EaglePicher cells have successfully operated in space for more than two billion hours

**Innovative Power** EaglePicher pioneered lithium-ion battery system applications in unmanned aerial vehicles

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TECHNOLOGIES



# Missiles and Munitions



With more than 50 years of experience in military power, EaglePicher has supplied batteries for hundreds of defense programs including JDAM, TOW, Tomahawk, Patriot, Hellfire, THAAD, standard missile, GBI/EKV, Trident and Harpoon.

Whatever the requirements, EaglePicher has the solution to power your military and aerospace missile applications.



**Silver Zinc batteries** provide power for missile guidance control, telemetry, tracking, flight termination and actuator systems.

- High energy density
- Flexible configurations
- Numerous qualified designs
- Long active life

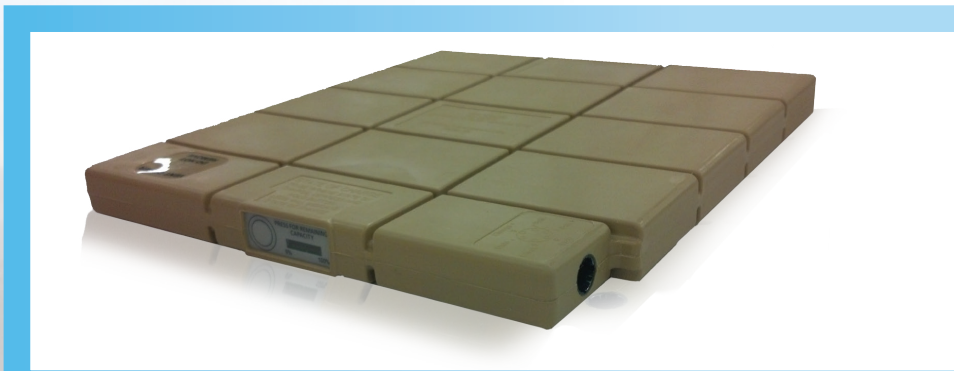
**Thermal batteries** are used in military and aerospace applications that require a long, maintenance-free shelf life in a full range of temperatures, climates, and dynamic environments.

- High volume production capacity
- Cost effective
- Automated production
- 20-year or longer storage life, no maintenance required

**Lithium Oxyhalide batteries** are used to power missiles and munitions that require batteries with a long shelf life and a high level of energy on demand.

- High energy density
- High power capability
- 20-year or longer storage life, no maintenance required





## Portable Power

Whether powering search and rescue equipment in the bitter arctic or communications equipment in the sweltering desert, failure is not an option. For more than 90 years, EaglePicher has designed and manufactured specialty batteries able to withstand some of the harshest conditions on Earth.

### Communications and Backup Power

EaglePicher is a critical battery technology supplier to the Department of Defense's multiple military campaigns

#### Applications include:

- Communication devices
- Unmanned aerial and unmanned underwater vehicles
- Ground robots
- Specialized emergency response, marine safety threat detection systems

Li-S, Li-Ion, Li-CFx and Li-CFx-MnO<sub>2</sub> batteries are available.

### Custom Battery Packaging:

With an unlimited choice of battery chemistries, EaglePicher offers both non-rechargeable and rechargeable products that provide main power and memory back-up in a broad range of applications including:

- Naval vessels
- Combat robots
- Communication systems

### Commercial Power Solutions

EaglePicher delivers leading-edge technologies for high performance products to match your application needs. Our portfolio is vast, offering quality batteries in unique shapes and sizes. EaglePicher's Carefree® and Keeper® product lines support business, industrial, medical and recreational industries.

#### Applications include:

- Carefree® ride on toys, fire panels, emergency lights, UPS systems, wheel chairs and golf carts
- Keeper® medical devices, GPS systems, military electronics, automotive, remote monitoring, oceanographic buoys, deep hole drilling, and asset tracking





# Space and Satellite

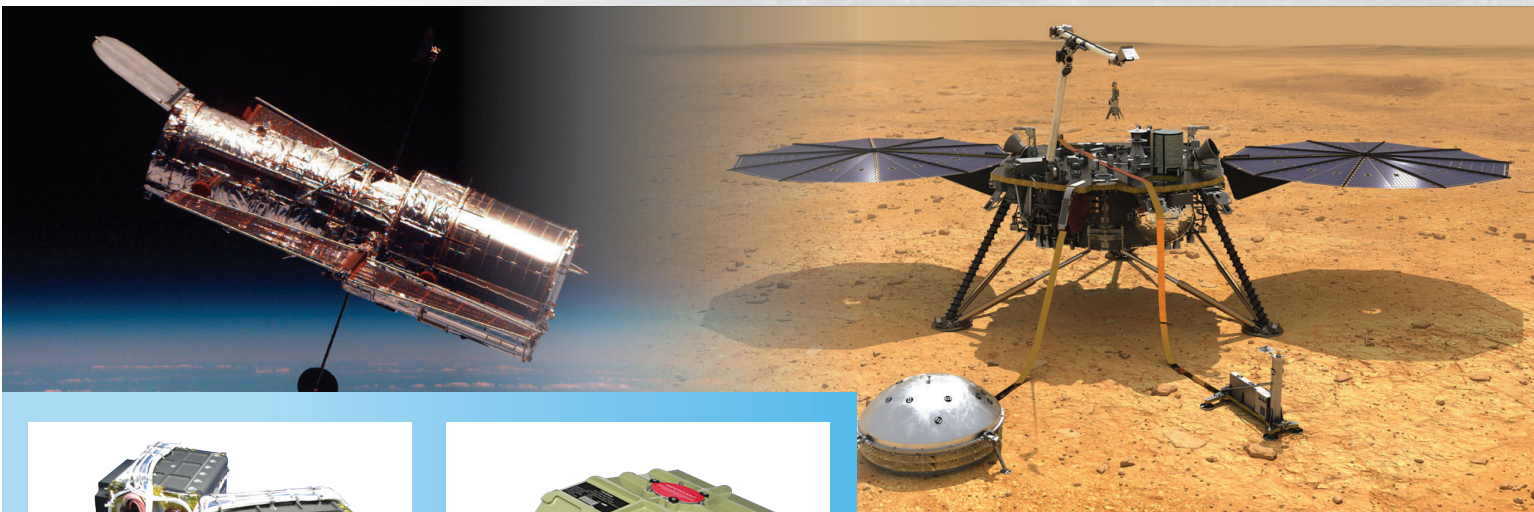
**EaglePicher is one of the most trusted suppliers in the space business. Since America's early days in space, EaglePicher has powered manned and unmanned missions including Mercury, Gemini, Apollo and Lunar Rover. Today EaglePicher powers over 500 active commercial, military and scientific missions including Mars Rover, Curiosity Rover, Hubble Telescope, International Space Station and Global Positioning Satellite (GPS) Constellations.**

## **Custom Technology**

To date, EaglePicher has designed and manufactured space grade cells in a variety of sizes, ranging from nominal capacities between 6 Ah and 250 Ah. Each cell design can be customized in a battery configuration to meet nearly any mission requirement. New space technology such as lithium ion combined with legacy technologies will ensure that EaglePicher's reputation for quality and dependability will continue into the future and build on our 50 plus year space mission legacy with over two billion cell hours in space without a mission failure.

## **Proven Capabilities in the Most Intense Situations**

When an oxygen tank explosion crippled the Apollo 13 spacecraft during its lunar mission in 1970, the safe return of three brave American astronauts depended heavily upon the EaglePicher silver zinc batteries on board the spacecraft.



**After more than two billion cell hours in space, operations using EaglePicher batteries continue at 100% mission success.**

Photos courtesy of NASA



# Launchers

Since the beginning of the Space Age, EaglePicher has been trusted to power historical NASA launches including Mercury, Gemini, Apollo and Skylab.

From the original Saturn V launchers in the early years to current Atlas and Sea Launch vehicles, EaglePicher continues to support even the most challenging government and commercial applications.

EaglePicher's silver zinc batteries have a long active life and offer flexible configurations to meet various packaging requirements.

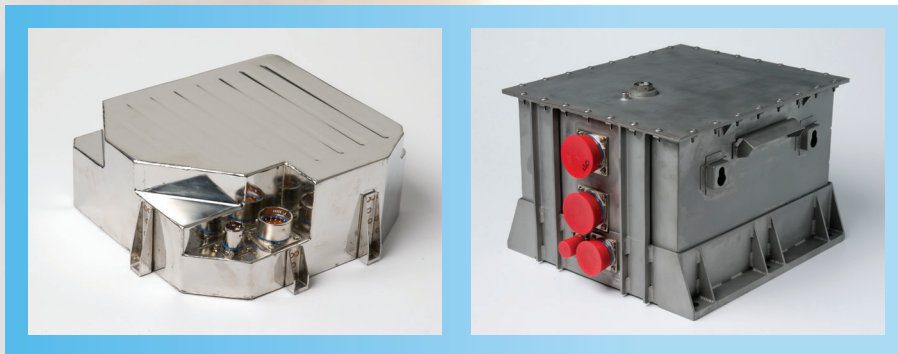
## Custom Technology

EaglePicher batteries power a wide range of on-board launcher systems including:

- Flight termination
- Telemetry
- Guidance control
- Electronics

## Custom Technology

With its wealth of battery expertise as the foundation, EaglePicher is advancing lithium-ion — the next sought after battery technology. The benefits for launchers — higher energy density and improved charge retention.



# Aircraft Power

**With a wide range of battery types for aircraft systems, EaglePicher's most recent advances have been in the safety improvements for lithium-ion technology. With a state-of-the-art battery management system in combination with novel assembly techniques and improved materials, EaglePicher's lithium-ion main aircraft batteries are considered the safest on the market.**

## Applications:

- Main engine start
- Emergency backup
- Flight instrumentation
- Avionics
- Auxiliary power unit

## Platforms:

- Fixed-wing
- Rotorcraft
- Unmanned aerial vehicle



## Custom Battery Designs

With an unlimited choice of battery chemistries, EaglePicher offers primary (non-rechargeable) and secondary (rechargeable) products that meet the most stringent electrical, environmental and dynamic requirements.

## Qualified battery Systems

EaglePicher offers lithium-ion batteries fully qualified with TSO to C-179A under the guidelines of DO-311, DO-160G and DO-178, design authority level (DAL) B for software. Advanced, high-capacity lithium-ion batteries are also available with proprietary prismatic cell technology. These batteries are available with platform-specific qualifications.

Department of Defense Photo by Petty Officer 3rd Class Jimmy C. Pan, U.S. Navy

# Battery Management Systems

**Rapid development and implementation enabled by software stability and modularity.**

For aircraft, EaglePicher has developed a proprietary battery management system and software to DO-178, DAL B. Battery management systems have been developed for other applications at EaglePicher and is an area of expertise for us, where virtually any custom solution may be developed.

To optimize the battery's performance over long, high-cycle life missions EaglePicher's batteries can be equipped with battery management electronics within the battery design. The electronics provide autonomous and commanded cell equalization during the charge portion of the cycle at an individual cell basis. This provides cell uniformity within the battery assembly and extends the performance and life of the battery to meet 10 year low earth orbit mission requirements.

No matter what the challenge, you can count on EaglePicher to deliver the outstanding performance, safety and quality you require.



## Robust Operations

- Safety
- Reliability
- Compatibility

## Enables Critical Functions

- Protection
- Control
- Communication
- Charger management



# Research and Development

EaglePicher has always been focused on technology—it is our heritage. Through state-of-the-art research and development facilities, we bring advanced engineering solutions and the latest scientific discoveries directly to customers—in the shortest time.

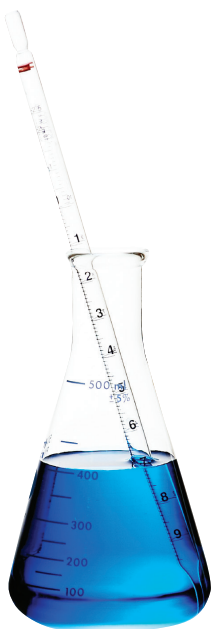
EaglePicher's research and development centers are equipped with advanced processing equipment, sophisticated characterization tools and modeling capability for in-depth understanding of battery science.

## Research and development focuses on advanced technologies for current and future applications:

- Engineering designs and prototype construction
- New materials
- Battery electrochemistries
- Analytical chemistry
- Environmental study
- Electrical performance evaluation

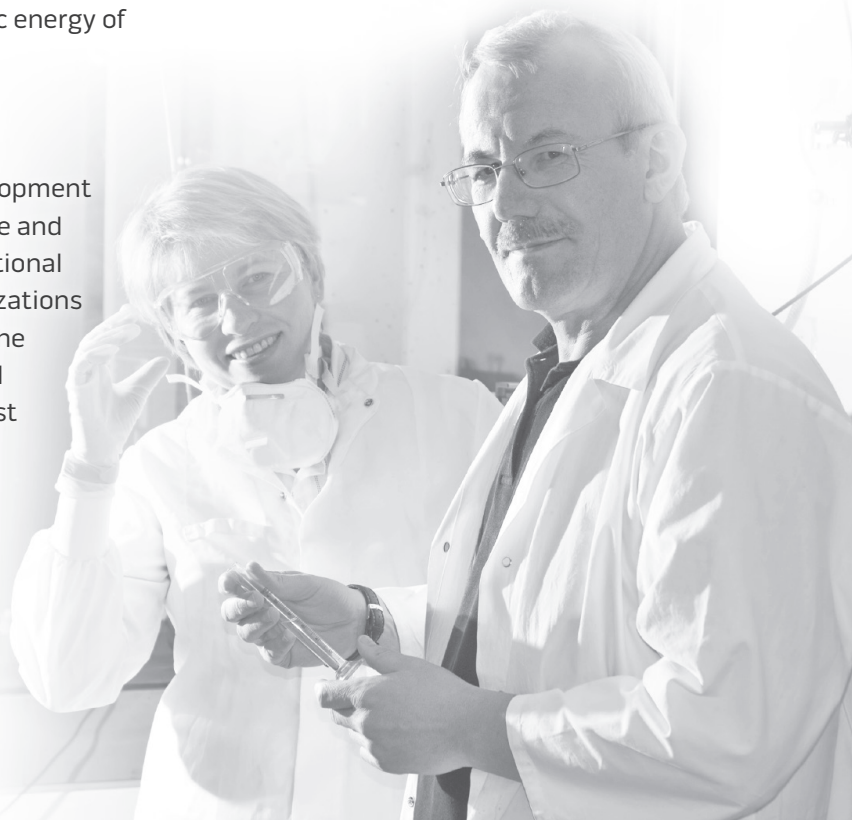
## Technology Developments:

- Thin film technology for thermal and other reserve batteries, promising superior power capability and a higher processing yield
- New, high power Li/CFx-MnO<sub>2</sub> battery technology that has been demonstrated to double the service life of current batteries
- World's smallest implantable rechargeable battery
- Cell power management and balance control for lithium-ion batteries with a charger system that can be used or adapted to multiple chemistries
- Improvements to the next generation lithium oxyhalide electrochemistry
- An advanced lithium-ion chemistry has been demonstrated that delivered > 250 Wh/Kg at 1C rate
- A new lithium sulfur chemistry developed with a specific energy of more than 300 Wh/Kg.



## The Power of Knowledge

EaglePicher's research and development centers work closely with defense and aerospace prime contractors, national laboratories, government organizations and various universities across the country to leverage research and knowledge for the best of the best in developing technologies.



# Lithium Ion

**EaglePicher is applying its energy expertise to the advancement of lithium ion — the latest and most advanced battery technology.**

## Leadership

- First to launch large prismatic lithium-ion battery into orbit
- Multiple research grants and contracts for advanced lithium-ion development
- First to market with lithium-ion cells for rechargeable implantable medical devices

## Product Innovation

EaglePicher is a leader in the development of lithium-ion for aerospace, defense, underwater, medical and other elite markets.

- Improvement in battery packaging efficiency using true prismatic design over cylindrical
- Increased battery performance and safety with battery management system circuitry
- State-of-the-art research and development, cell and battery manufacturing facilities

## Process Innovation

EaglePicher is committed to satisfying emerging customer application needs by utilizing only the most advanced equipment and innovative processes to bring lithium-ion technology to the market.

- Optimized process design for lean manufacturing and just-in-time product management
- Advanced precision manufacturing controls and automation
- Dedicated air handling system to avoid cross contamination
- Paperless tracking of all cell / battery build and performance data

## Nanotechnology Research

EaglePicher is researching the incorporation of nano materials to maximize output, reduce the size and weight of current systems, increase performance and cycle life, while reducing costs for lithium-ion batteries - all while improving safety and stability in harsh environments.



6 Ah Space Cell



Contego® 50 mAh Battery



# Energetic Devices

**Transforming energy to get the job done. Where you want it. When you need it.**

EaglePicher's energetic devices have supported nearly every major defense program since 1965. Our various energetic device products have emerged from EaglePicher Technologies' long-standing specialty battery business. Since its introduction to the industry in 1922, EaglePicher Technologies has become the most diversified battery manufacturer in the world. When you demand the highest quality and most reliable energetic devices, EaglePicher is the only name you need to know.

EaglePicher manufactures a wide variety of pyrotechnic devices including igniters, gas generators, cutters, pyrotechnic switches and forward or reverse motion actuators. Other specialty devices include infrared emitters, inertial set-back igniters and integrated assemblies. Many devices are available with built-in time delay and one-amp/one-watt firing characteristics. Variations also include size, power, input requirements, environmental resistance, material composition and configuration.

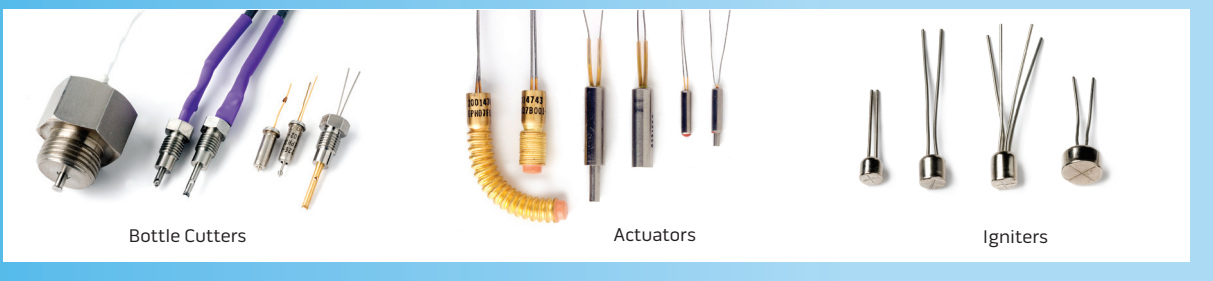
## Applications:

- Missiles
- Ordnance
- Cartridge- and propellant-actuated devices (CAD/PAD)
- Space and aerospace

In addition to our mentioned products, EaglePicher can design and manufacture customized explosive and pyrotechnic devices or modify existing designs to meet your requirements.

Under a multitude of user-specified conditions, integrated in a variety of subsystems, the end results are the same:

**consistent, reliable performance.**





# Increase Your Expectations

Demands on technology call for smaller and lighter products, more energy and increased safety. EaglePicher brings the newest technology innovations, offers custom battery development and can fully support the customer from concept through final production.

Whether it is EaglePicher's cutting-edge research on lithium-ion technology or the world's smallest human implantable battery, we continue to set new standards. Most importantly, EaglePicher ensures that the right power is always available — not just for convenience — but when it's a matter of life and death.

## FROM **ELECTROCHEMISTRY** TO **CELLS** TO **BATTERIES** TO **COMPLETE POWER SYSTEMS,**

you can trust EaglePicher's comprehensive energy solutions to deliver power where you want it, when you need it.