ADVANCED & VERSATILE
LITHIUM ION BATTERY SOLUTION
FOR MARINE/SUBMARINE INDUSTRY
DEPLOYMENT OF MORE THAN 50 MWh WITH KOKAM LITHIUM ION BATTERY TECHNOLOGY IN MARINE & SUBMARINE INDUSTRY
KOKAM IN BRIEF

As a globally acknowledged battery manufacturer and battery solution provider, Kokam has developed customer-centered, reliable, safe, high performing, and eco-friendly solution for the past 31 years. Kokam manufactures over 30 different types of lithium ion batteries for variety of military applications such as Fighter Jets, Armed Fighting & Support Vehicles, Mobile Energy Storage Systems(ESS), and Portable Devices. Kokam battery has pioneered applications in Unmanned Aviation and Ground Vehicles(UAV & UGV), and Unmanned Underwater Vehicles(UUV). With 31 years of field experience, Kokam has installed over 600MWh of batteries around the world. Kokam’s technology has been proven to be high performing, reliable, durable, and safe.

A LITHIUM ION BATTERY THAT MEETS YOUR APPLICATION’S NEEDS

UAV / DRONE / FIGHTER JET:
UAVs are controlled from ground-based stations. Such advanced vehicles require advanced sensory, communication and power components to ensure a safe and reliable flight. Installing high tech components into a relatively small UAV is often impractical. However compact features of lithium ion battery allows additional space within the UAVs, which could be used to accommodate various components. The Lithium ion battery is the most safe and quiet power source for UAVs.

ARmed FIGHTING & SUPPORT VEHICLE:
High energy density, high power and light weight lithium ion battery improves the mobility of wheeled vehicles. More military transport, combat, and unmanned vehicles are turning toward fully electrical or hybrid systems where the battery becomes the primary source of power propulsion.

UUV / TORPEDO / SUBMARINE:
Lithium ion battery is the best source of power for UUV, Torpedo and Submarine. Its compact design brings higher efficiency and strengthens reliability for diverse marine application.

MOBILE ESS:
Kokam’s Mobile ESS provides sufficient energy for various devices in the battlefield. Compared to the conventional diesel generator, it releases less noise and heat, allowing for more efficient energy supply.

PORTABLE DEVICE / COMMUNICATION TOWER:
Batteries are installed in various types of military communication equipments, providing reliable power under harsh conditions at critical times. The same technology is used for emergency power support in telecom stations and control facilities.
**KOKAM LITHIUM ION CELL**

“TRANSCEND THE LIMITATIONS WITH THE FUSION OF SUPERIOR CELL CHEMISTRY”

Kokam sets about to solve the limitations associated with conventional lithium ion Battery technology, including cycle and calendar life, safety, recharge time, power delivery, and ability to operate in extreme temperatures. The performance and features of this technology surpass other existing battery capabilities in the market space today.

**HIGH ENERGY NMC (NICKEL MANGANESE COBALT)**

**Advantages**
- Improved energy density (Up to 5.4MWh of batteries can be stored in a 40ft container)
- More than 95% of high efficiency at 0.5C
- Competitive price: The NMC cells have an advantage in terms of price, when considering their superior performance, cycle life, reliability and safety features

**HIGH POWER NMC**

**Advantages**
- Improved performance with 6C discharge
- Improved performance with 3C charge
- Improved high power cycle life
- Up to 3MWh of batteries can be stored in a 40ft container
- Special coating is applied to cathode to improve high power performance

**ULTRA HIGH POWER NMC**

**Advantages**
- High C-rate up to 30C-rate level (Limited to SLPB98188216P Cell)
- High C-rate discharge performance for uses in frequency regulation, UPS, etc.
- Improved performance without safety or cycle life trade off

**NMC + LFP+LTO (NANO)**

**Advantages**
- Specially designed for defense & aerospace applications
- This hybrid type cell has incorporated the advantages of NMC, LFP and LTO technology in one cell. It is suitable for extremely volatile and dynamic operational conditions. The high power, energy and safety features allow the NANO cells to be flexibly applied in various applications
LITHIUM ION BATTERY SYSTEMS FOR MARINE ESS
DESIGNED FOR EXTREME SAFETY & RELIABILITY

SPECIFICATION
- 85Ah HP & 103Ah HE cells, 2P20S
- 12.5kWh & 15.1kWh capacity, 73.6Vdc
- Cycle Life @ DoD 80% : >8,000 (@ 25±3°C, 1C/1C, SOH 70%)
- IP Grade : 54

EXTREMELY SAFE BATTERY SYSTEMS.
Kokam has developed water cooling lithium ion Battery suitable for the marine applications which require extreme safety and reliability under harsh ocean environment. It provides peak shaving capability against momentary high energy burst to enable commercial vessels or offshore supporting vessels to save fuel and extend the life of main engines or generators. Additionally, this module can be used for inland vehicles like trucks, buses and trams which require high maneuverability and regeneration absorbing capability.

SAFETY
Prevents thermal runaway

PERFORMANCE
Maximum performance, smallest systems

VALUE
Lifetime value best in industry

APPLICATIONS
- Hybrid Electric System in commercial and offshore vessels
- Electric Propulsion System

KEY FEATURES
- Direct water cooling with water jacket inserted between the cells
- IP54 and salinity resistive housing
- Easy change of module length according to the customer requirement
- Thermal runaway tested according to classification society rules
- Shock, vibration, temperature, EMI/EMC, Salinity tested according to classification society rules
- Ship Roll and Pitch tested according to submarine/ship motion requirement

*The product image is for reference purpose. The actual product may be different.
With its flexible and modular design, Kokam’s Battery Module can be customized to meet various technical needs.

Reliability of batteries in military, marine and aviation is vital to its performance. Kokam’s lithium ion batteries are capable of operating over a wide temperature range, which is ideal for rugged military use. Kokam provides high-tech solutions for various military applications ranging from small portable electronics to highly sophisticated machinery, ensuring that it is always prepared for the unexpected.
Scandlines Hybrid Ferry Project

- Solution: Integrated with Kokam battery technology
- Application: Marine propulsion
- Capacity: 2.7MWh
- Characteristics: World's largest hybrid passenger ferry
  Can propel the 15,000-tonne ship for about 30 minutes without diesel fuel

Kokam’s battery maximizes the performance of electric boats. With its high energy density, Kokam provides battery solutions which are significantly smaller in size and weigh less than competitive products. In addition, Kokam batteries’ outstanding power output is favorable as a starting power source that cranks the engine with a momentary high power burst.
SAFETY CENTERED
• Intrinsic safety of cell chemistry
• Smart short circuit protection
• Heat and electric insulation packaging system

UNPRECEDENTED LONGEVITY
• More than a decade of life proven at sea
• Lower capacity fading rate
• Low internal resistance

PROVEN RELIABILITY
• More than a decade of fault-free recorded operation
• LBTS durance & abuse tested

FULL CUSTOMIZATION SERVICE
• Chemical tuning for the best optimization
• Scalability of hardware and software
• Full in-house design and production

SUBMARINE
DEPLOYMENT OF LITHIUM ION BATTERY POWER STRATEGIC ADVANTAGE
Advanced technology in lithium ion battery is enabling strategic advantages in marine applications. The battery has high energy density both in weight and volume, coupled with the capacity to rapidly charge and discharge, delivering immense amounts of power over many thousands of cycles with minimum degradation. Compared to the lead acid batteries, the lithium ion battery delivers higher amounts of stored energy and power.

Kokam is a world market in the field of lithium ion battery for maritime applications. Examples of large scale deployment of Kokam lithium ion battery include, electric propulsion of surface ships (100% battery powered ferries with displacement of up to 3000 tonnes); hybrid ship propulsion to reduce fuel consumption and boost peak power, thus reducing reliance on gas turbines and propulsion of diesel electric submarines with the strategic advantages of increased sub surface range, higher speed, and reduced surface charge time.

As with all technology deployments, safe operation requires a fully engineered solution. In addition, selecting the most suitable technology for each application is imperative for a successful deployment.

For example, the propelling characteristic of a torpedo is remarkably different compared to that of a submarine. Kokam offers customized cells that are best suitable for specific applications.

Kokam ensures the safety of the cells by selecting the appropriate chemical ingredients and adopting rigorous quality management procedures. That is why Kokam has over 10 years of incident-free deployment of lithium ion cells in marine applications such as the UUVs, submarines, and torpedoes.
Kokam’s high-performance lithium ion battery technology delivers high power and energy density combined with excellent safety performance and cycle life.

**ENERGY:**
Higher usable energy means greater battery utilization and lower cost

**POWER:**
Superior power by weight or volume in a cost effective solution

**CYCLE:**
Excellent calendar and cycle life with consistent performance over extended use

batterysolutions@kokam.com