



## Securaplane lithium FAQ

Rechargeable lithium batteries are ubiquitous in our daily lives, from key fobs to billion dollar space programs, in benign as well as extreme environments. Securaplane, an aircraft security and safety specialist, has been pioneering lithium in aerospace for over a decade. It remains at the cutting edge of this enabling technology with a product that is not just a battery but a system.

Securaplane's System Lithium is a cluster of very small, low-output smartphone-type cells wrapped in a sophisticated monitoring and health management package. That's why it is as safe as conventional aircraft battery technology, yet lighter and more powerful by far.

### 1. Why is the aviation industry using lithium?

Rechargeable lithium batteries have been installed on Airbus, Boeing and Cessna aircraft because of the weight savings lithium technology can bring. Lighter aircraft consume less fuel, improving economics and range.

Broadly, lithium batteries weigh up to 50% less than those made using conventional chemistries such as sealed lead acid and nickel cadmium. As lithium batteries increase in power density, the civil aviation industry expects to save between 100 and 200 lbs across a single platform.

In some instances, military aircraft manufacturers regard the development of lithium technology as mission critical. With the exponential use of electronic systems, only lithium chemistry-based systems have the power density needed to operate and cool them. Alternative chemistries would simply be too heavy and big to be practicable.

### 2. What is the difference between lithium and conventional batteries?

Conventional batteries are cells packaged inside a protective skin. By contrast, the predominant commercial lithium cell chemistries deploy significant electronic content within special structures to support cell management and prolong life.

### 3. How does Securaplane use lithium?

Securaplane produces main ship and emergency rechargeable lithium batteries similar in Amp-hour capacity to traditional aircraft battery chemistries. These include lead acid and nickel cadmium options in which we also have significant experience.

Securaplane has been at the forefront of lithium battery technology for ten years and its current product line incorporates a decade of learning from the industry and advances in lithium chemistry itself.

Securaplane's System Lithium is based on a combination of optimal chemistry; well-designed structures; and systems that promote health management for safe, reliable, low-maintenance operation.

### 4. How experienced is Securaplane in the lithium field?

Securaplane has been delivering primary (non-rechargeable) lithium batteries for aviation since the mid-1990s. At that time, we chose lithium thionyl chloride for smoke detectors in cargo holds with no power available for recharge. Thousands of these batteries remain in trouble-free service to this day. Our latest programs include wireless emergency systems and power storage for military electronics cooling.

### 5. Why does Securaplane refer to its lithium battery as a "system"?

Although technically called a battery, many aviation lithium batteries and Securaplane's rechargeable lithium battery system contain sophisticated electronic circuits that support all internal cell needs. Open a Securaplane rechargeable lithium battery and you will immediately see electronic circuitry that is very different to those of traditional lead acid or nickel cadmium, which will have cells interconnected via wires and bus work within the enclosure; and electronic components such as temperature sensors.

Securaplane's rechargeable lithium battery enclosures contain thousands of electronic components on multiple



circuit packs. With cells for energy storage, you will find controlled chargers and charging algorithms and circuitry for environmental control, cell health management, cell and battery disconnect, cell load management and the communication of maintenance notifications to crew and ground personnel. That's why a Securaplane rechargeable lithium battery is more than just a battery, it is a system.

#### 6. Are all lithium cell chemistries the same?

There are numerous chemistries in the rechargeable lithium battery category, each with different characteristics across the performance spectrum, ranging from energy density to cycle life. Many cells combine chemistries to meet the requirements of a given application. Even within the same chemistry, there are various processes and mixes.

The main competing cell chemistries are cobalt, manganese, and iron phosphate. All are suitable for civil aviation applications, providing they are incorporated within appropriate system designs and construction.

#### 7. What kind of lithium does Securaplane use?

Since Securaplane's original use of lithium thionyl chloride ten years ago, the lithium landscape has evolved rapidly and we have more lithium chemistries to choose from. We have chosen lithium iron phosphate chemistry for our rechargeable lithium battery systems for its combination of stability and utility. This chemistry delivers significant performance benefits over those using traditional chemistries and is just as safe when combined with appropriate electronic management systems.

#### 8. What is the difference between Securaplane's lithium battery and other lithium batteries?

Securaplane lithium batteries combine advanced electronics for charging, environmentally controlling, and engaging, managing and disengaging small format lithium iron phosphate cells.

#### 9. How safe is lithium?

Lithium chemistries are safe, providing they are used within appropriate system designs and construction. All Securaplane batteries contain a battery management unit to monitor and control all cell activity. Sophisticated controls for state of health and charge monitor multiple currents, dozens of temperatures and cell voltages to ensure

instantaneous data availability and the ability to manage cells throughout their operating life.

- Securaplane lithium battery systems have numerous internal and external protection mechanisms to safeguard overcharge conditions.
- Securaplane lithium cells are about the size of a C cell or the volume of a smart phone battery. Consequently, single cell failures simply don't have enough energy when shorted to cause the temperature of the battery case to rise significantly.
- Securaplane cells have multiple layers of external short circuit protection.
- Securaplane rechargeable lithium battery cells have been overheated in tests at extreme temperatures without any flame conditions arising.

#### 10. How is lithium battery safety regulated?

The RTCA DO-160 Environmental Conditions and Test Procedures for Airborne Equipment are applied rigorously to lithium batteries.

However, the Federal Aviation Administration also requires the application of the RTCA DO-311. This prescribes strict testing to ensure lithium battery system performance and characterization, plus tests designed to aggressively fail the battery in the worst conceivable ways possible. This includes removal of designed-in protective functions that would otherwise prevent failure. DO-311 testing goes well above the testing that would be required for more traditional battery chemistries such as lead acid or nickel cadmium.

The United States Department of Transport (DOT) requires eight stress tests including short circuit and impact where batteries are severely impacted in an attempt to crush the cell. Securaplane's System Lithium is currently going through the DO311 and DOT tests.

#### 11. Do rechargeable lithium batteries require special handling?

Handling requirements for lithium are similar to those using other traditional chemistries.



### **12. How reliable are lithium batteries, given their extensive electronic systems?**

The electronic systems within Securaplane's rechargeable lithium battery system actually improve reliability. Because the electronics monitor various parameters and maintain a balanced charge across the battery, we expect mean time between failure rates to exceed those of traditional chemistries such as sealed lead acid or nickel cadmium.

### **13. Do lithium batteries have similar maintenance requirements as traditional battery chemistries?**

Yes, when compared to Securaplane's Hawker Sealed Lead Acid chemistry. Nickel cadmium (NiCad), however, requires more frequent periodic maintenance and internal cell servicing.

### **14. What is the life span of lithium batteries compared to other batteries?**

Securaplane lithium batteries are designed for 20-year life with lithium cell "reblocking" every three to four years. The internal cells' life is a function of environment but is equivalent to Securaplane's Hawker Sealed Lead Acid (SLA) batteries.

### **15. Is the lifecycle cost of rechargeable lithium batteries higher than SLA or NiCad?**

Rechargeable lithium batteries can be repaired or "reblocked" based on service condition. The presence of lithium battery systems mean that the mean time between failure of rechargeable lithium batteries will exceed traditional chemistries, resulting in longer time on wing. Based on these two elements, we expect the lifecycle costs of rechargeable lithium batteries to be in line with lifecycle costs of other common battery chemistries.