

# Certification Challenges to Advanced UAV Batteries in India

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*As the global shift towards the ‘electrification of everything’ accelerates, battery technology has emerged as a critical enabler across various industries. The post-pandemic era has seen a significant growth in the Unmanned Aerial Vehicle (UAV) and drone industry, necessitating the development of high-power density, non-explosive and durable batteries. Current standards, such as those defined by the Bureau of Indian Standards (BIS) and the Directorate General of Civil Aviation (DGCA), primarily focus on nickel and lithium-based chemistries, leaving emerging technologies like graphene, sodium and aluminum-based batteries, outside the regulatory framework. This commentary explores the challenges faced in accommodating evolving battery technologies for UAV applications and recommends the development of a technology-agnostic regulatory and certification framework to promote innovations and safety in this rapidly advancing field.*

## THE ELECTRIFICATION PARADIGM

The global transition towards the ‘electrification of everything’ is reshaping industries, driven by the need for sustainable and efficient energy

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solutions. Central to this transition is the development of advanced battery technologies that can support a wide range of applications, from electric vehicles to renewable energy storage and beyond. The UAV and drone industry, in particular, has experienced exponential growth, leveraging advancements in battery technology to enhance performance, endurance and safety.

### **GROWTH OF THE UAV INDUSTRY**

In the aftermath of the COVID-19 pandemic, the UAV and drone industry has witnessed significant expansion, both in India and globally. These technologies are increasingly being utilised for a variety of applications, including aerial photography, agriculture, delivery services and surveillance. As the UAVs become more prevalent, the demand for high-performance batteries that are both powerful and safe has become paramount.

### **CURRENT BATTERY STANDARDS AND LIMITATIONS**

Presently, battery standards set by regulatory bodies, such as the Bureau of Indian Standards (BIS) and the Directorate General of Civil Aviation (DGCA), are primarily focused on nickel and lithium-based battery systems.<sup>1</sup> For instance, BIS standards, IS 16046 (Part 1): 2018/IEC 62133-2: 2017<sup>2</sup> and IS 16046 (Part 2): 2018,<sup>3</sup> cater specifically to nickel and lithium systems, respectively. These standards are critical for ensuring safety and reliability of batteries used in the UAVs. However, the rapid pace of innovation in battery technology has led to the development of new chemistries that fall outside the scope of these established standards.

### **EMERGING BATTERY TECHNOLOGIES**

Several universities and research laboratories worldwide are exploring alternative chemistries to enhance battery performance.<sup>4</sup> These include graphene, sodium and aluminum-based batteries, which offer promising attributes, such as higher energy densities, improved safety profiles and greater durability. Despite their potential, these advanced chemistries are not currently accommodated within the existing BIS certification framework, posing significant challenges for their adoption in the UAV industry.

## CASE STUDY: DREAMFLY INNOVATIONS

Dreamfly Innovations, a Bangalore-based company, has developed high-performance, non-explosive batteries based on graphene.<sup>5</sup> Despite their superior characteristics, these batteries do not fall under the existing BIS standards for nickel and lithium systems. Consequently, the UAV manufacturers are unable to obtain type certification for these advanced batteries, hindering their deployment and the potential benefits they offer. Similarly, other innovators in India would also be exploring and, in some cases, developing advanced batteries to meet future requirements of the emerging drone industry in India.

### THE NEED FOR A TECHNOLOGY-AGNOSTIC REGULATORY AND CERTIFICATION FRAMEWORK

To foster the development and adoption of innovative battery technologies, it is essential to establish a technology-agnostic regulatory and certification framework. Such a framework should be flexible enough to accommodate new chemistries and advancements, ensuring that they can be evaluated and certified for safety and performance without being restricted by existing standards.

#### **Promoting Innovation**

Innovation in battery technology is crucial for the continued advancement of the UAV industry. By developing a regulatory and certification framework that can accommodate new and emerging technologies, regulatory and certification entities can ensure that innovations are not stifled by outdated standards. This approach would encourage research and development, leading to the creation of batteries that are more efficient, safer and better suited to the specific needs of UAV applications.

#### **Ensuring Safety**

While promoting innovation, it is equally important to ensure the safety and reliability of new battery technologies. A technology-agnostic regulatory and certification framework would include mechanisms for rigorous testing and evaluation of advanced chemistries, ensuring that they meet the necessary safety standards before being deployed in the UAVs. This would help mitigate the risks associated with new technologies, providing assurance to manufacturers, regulators and consumers.

## CHALLENGES IN ACCOMMODATING EVOLVING BATTERY TECHNOLOGIES

### **Regulatory Challenges**

The primary regulatory challenge in accommodating evolving battery technologies lies in the rigidity of current standards. The BIS and DGCA guidelines are highly specific to certain chemistries, making it difficult to certify batteries that fall outside these categories. This rigidity can stifle innovation by Indian innovators as well as delay the introduction of potentially superior battery technologies by Indian companies into the domestic and global markets, which is essential to make India a global drone hub by 2030.

### **Market Acceptance**

Market acceptance of new battery technologies is another significant challenge. The UAV manufacturers and operators may be hesitant to adopt new chemistries without a clear understanding of standards and certifications, which can make it difficult for new technologies to gain traction in the market. Formulation of trial-based standards and certification mechanisms are needed to promote faster adoption of emerging technologies. The certification by Indian certification bodies and dissemination of such information can generate confidence among potential users.

## RECOMMENDATIONS FOR A TECHNOLOGY-AGNOSTIC REGULATORY FRAMEWORK

### **Developing Inclusive Standards**

Regulatory bodies should develop inclusive standards that can accommodate a wide range of battery chemistries. This could involve creating broad performance-based criteria that focus on key attributes, such as energy density, safety and durability, rather than specifying particular chemistries. By doing so, regulators can ensure that new technologies are not excluded simply because they do not fit within the existing categories.

### **Proactive Trial-based Clearance**

To promote the adoption of advanced battery technologies, regulators could implement a proactive trial-based clearance process. This would allow

companies to conduct real-world trials of new batteries under controlled conditions, providing valuable data on their performance and safety. Based on the outcomes of these trials, regulators could grant provisional certifications, facilitating the gradual integration of new technologies into the market.

### **Collaboration between Stakeholders**

Effective regulation of advanced battery technologies requires collaboration between various stakeholders, including regulatory bodies, industry players and research institutions. By working together, these stakeholders can develop comprehensive standards and testing protocols that ensure the safety and reliability of new batteries while promoting innovation.

### **Continuous Review and Updation of Standards**

Given the rapid pace of technological advancement, it is essential that regulatory standards are continuously reviewed and updated. This would ensure that the regulatory framework remains relevant and can accommodate new technologies as they emerge. Regular reviews could be conducted by committees comprising experts from industry, academia and regulatory bodies, ensuring a balanced and informed approach to standard setting.

## **CONCLUSION**

The UAV and drone industry stands at the forefront of technological innovation, driven by advancements in battery technology. However, the current regulatory framework, with its focus on nickel and lithium-based chemistries, poses significant challenges to the adoption of new and potentially superior battery technologies. To address these challenges, it is imperative to develop a technology-agnostic regulatory, standards formulation and certification framework that can accommodate a diverse range of battery chemistries. By doing so, regulatory and certification entities can promote innovation, ensure safety and support the continued growth of the UAV industry. The development of innovative, advanced, high-performance and low-risk batteries, as deliberated in the commentary, illustrates the potential benefits of such an approach, highlighting the need for a flexible and inclusive regulatory and certification environment that can keep pace with the evolving landscape of battery technology.

## NOTES

1. 'Certification Scheme for Unmanned Aircraft Systems (UAS)', Project Analysis and Documentation Division (PADD), Quality Council of India, available at <https://padd.qci.org.in/certification-scheme-for-unmanned-aircraft-systems/>.
2. BIS, IS 16046 (Part 1): 2018.
3. BIS, IS 16046 (Part 2): 2018.
4. Y.S. Meng, 'Introduction: Beyond Li-Ion Battery Chemistry', *Chemical Reviews*, Vol. 120, No. 14, 2020, available at <https://pubs.acs.org/doi/10.1021/acs.chemrev.0c00412?ref=pdf>.
5. See <http://www.dfi-india.com>.