4X faster time to market with automated R&D Data Pipeline

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Introduction

HOW ALTERGO'S TECHNOLOGY HELPS

Aiming to disrupt the aviation industry, US-based electric aerospace manufacturer is developing a vertical take-off and landing (eVTOL) aircraft. Early on, they decided to invest into battery R&D and battery management systems.

While investing a lot of time and effort in cell bench-marking and algorithm development to ensure safe operations of the aircraft, the eVTOL company struggled with managing analytics at different stages of their R&D cycle.

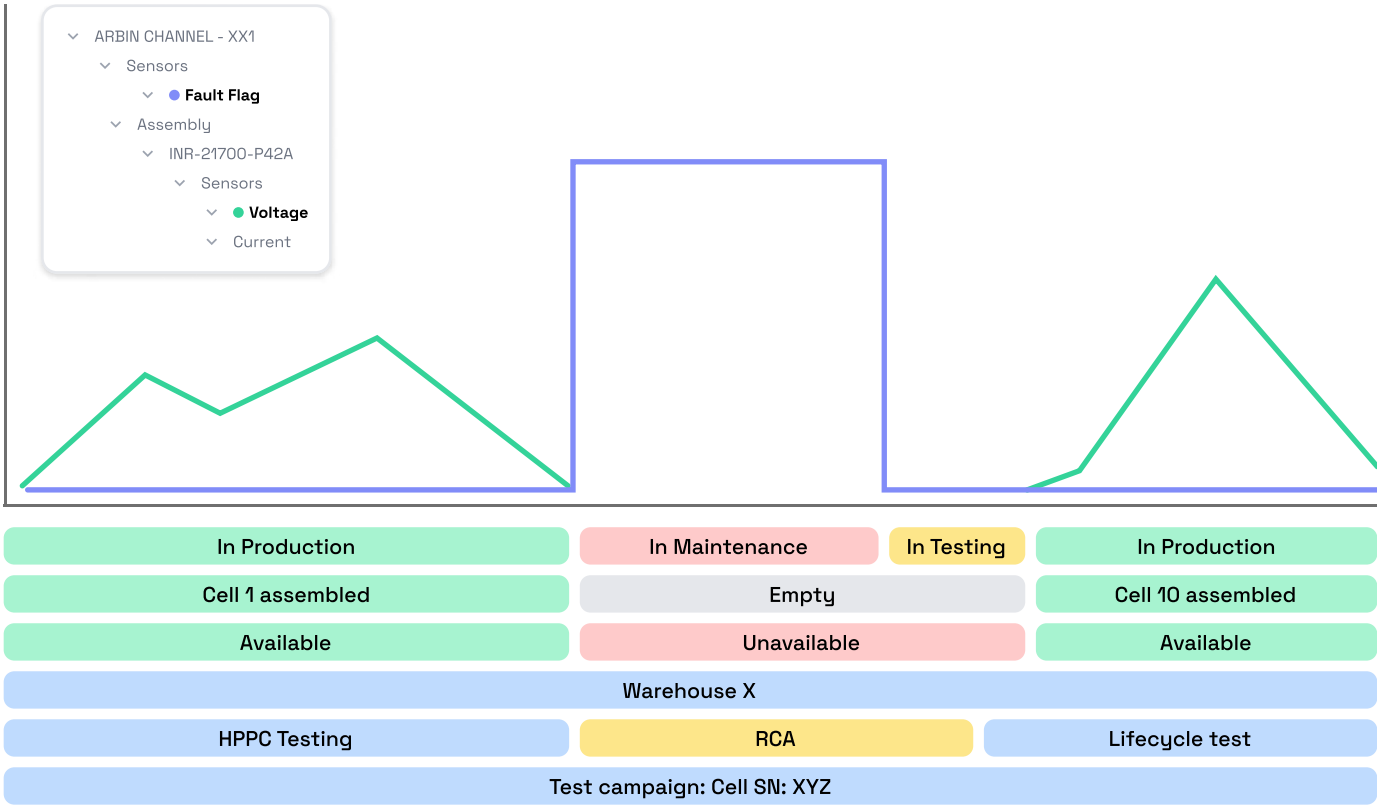
Challenges

The eVTOL company, recognized a pressing need for a sophisticated software solution to streamline its battery cell evaluation and selection process.
With the availability of the Arbin cell cycle bench for HPPC and lifecycle testing, the company was poised to gather essential data.
However, the lack of a systematic software framework to efficiently create a test and validation pipeline presented a challenge.
The stakes were high as the validation data would ultimately be used to generate certification reports for the FAA.

Altergo's Solution

Altergo's Digital Twin platform already had the feature set and infrastructure needed for organizing data following an ontological layering system.
Partnering with the eVTOL manufacturer's engineering team we were able to design an ingestion pipeline for the Data coming from the test benches as well as the Vehicles.
Creating this robust pipeline ensured the integrity of the data as well as standardized its format to comply with our visualization tools.
Since the data needed to be enshrined for the relevant authorities, we made sure to understand and implement rigorous data integrity checks and always preserved the incoming data along their converted formats.
During the pilot project, we worked on implementing specific data contextualization functions. It would allow any authorities or maintenance teams to access tracking information about test & validation to the cell level of each battery

Results



Following the completion of the pilot program, we delivered an integrated solution to the eVTOL manufacturer that streamlined data ingestion from multiple sources, including cyclers and EVTOL batteries. This infrastructure allows for automated storage of test data in cell Digital Twins within the Altergo cloud platform. The Altergo data format is designed to ensure compatibility with our Visualization Tool and Dashboard Engine.

Additionally, the system automatically populates contextual data such as test campaign references, cell manufacturers, and other relevant information. This is made accessible through the Activity Tracker feature on the platform.

The primary objective is to facilitate ongoing maintenance checks and meet regulatory inspection requirements.

Before this solution, the eVTOL manufacturer used table software to store data and manually cross-referenced lot numbers to locate associated data. The data was stored in a CSV format specific to Arbin, hindering direct visualization.

UPTO

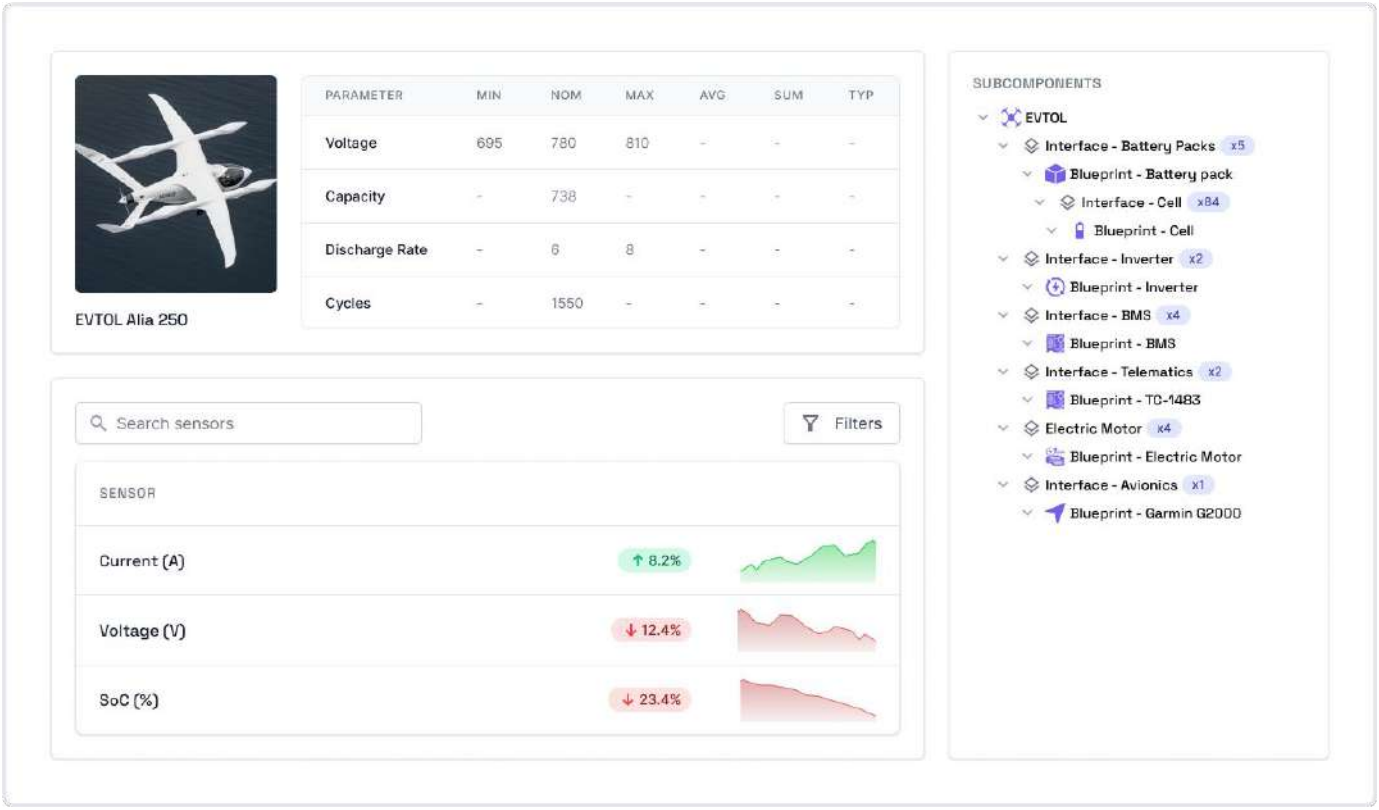
4X

TIME REDUCTION

Our analysis indicated that the automated system could reduce the time needed for a cell to transition from its initial test cycle to its first flight by up to 350%

Leveraging Digital Twin technology to harmonize data format

Digital Twin Creation



As a first step, we created multiple digital twin classes representing the batteries contained in the Aircraft.
The digital twin creation is done directly on the platform and facilitated through a step-by-step wizard specialized in battery design.
These digital twins are useful in multiple ways. They act as a container for all telemetry data coming from the field. They also ensure interoperability between this data and Altergo's estimation & prediction models, such as State of Health or State of Function.

Smart Ingestor

Since we can't know the data format in advance we developed a **Smart Ingestor**. Able to quickly map Sensor data to the Altergo data format. With no additional development and with a mostly automated process. Any source of data can be converted to the **Altergo Data Format**.

It's also the first step into a fully integrated ingestion pipeline that would bridge the gap between Arbin Cyclers and EVTOLs on the field as it provides a boilerplate for a custom development with the **Altergo SDK.**

Leveraging Digital Twin technology to harmonize data format

Providing a Universal data format for heterogeneous sources.

The **Universal Data Format** provides a standard for connecting all features on the platform to any data source in a consistent way. This enables data integration into a unified time series.

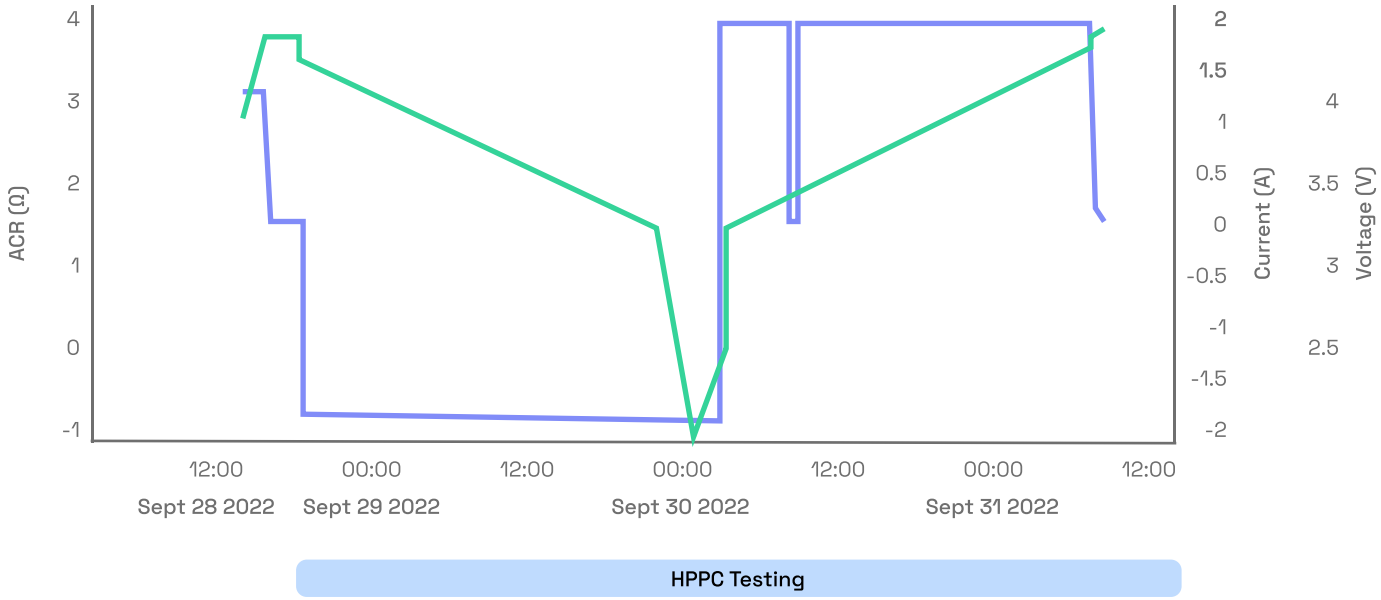
For example, the **Visualization Tool** can show voltage data from an Arbin Cycler test conducted at one point in time. This can be seamlessly combined with voltage data from a Battery Management System obtained years later.

The same standardization approach is beneficial for **Dashboards**.

These can now aggregate and display data from different components such as chargers, motors, and Vehicle Control Units. This makes it possible to view diverse sets of data in a single, cohesive presentation.

Integrating an automated ingestion pipeline - 1

Cell testing pattern recognition



Automating the process involves two main components. First, it facilitates a hands-off workflow for transferring data from the field to the Altergo Cloud. Second, it incorporates specific pattern recognition operations to relieve engineers and researchers from the task of contextualizing the data.

For instance, a solution combining standard algorithms and neural networks has been developed to automatically identify HPPC tests and Lifecycle tests.
This enables the efficient ingestion of large volumes of historical data without the need for manual classification.
As a result, a substantial amount of time is saved, eliminating the need for manual sorting and categorization.

Integrating an automated ingestion pipeline - 2

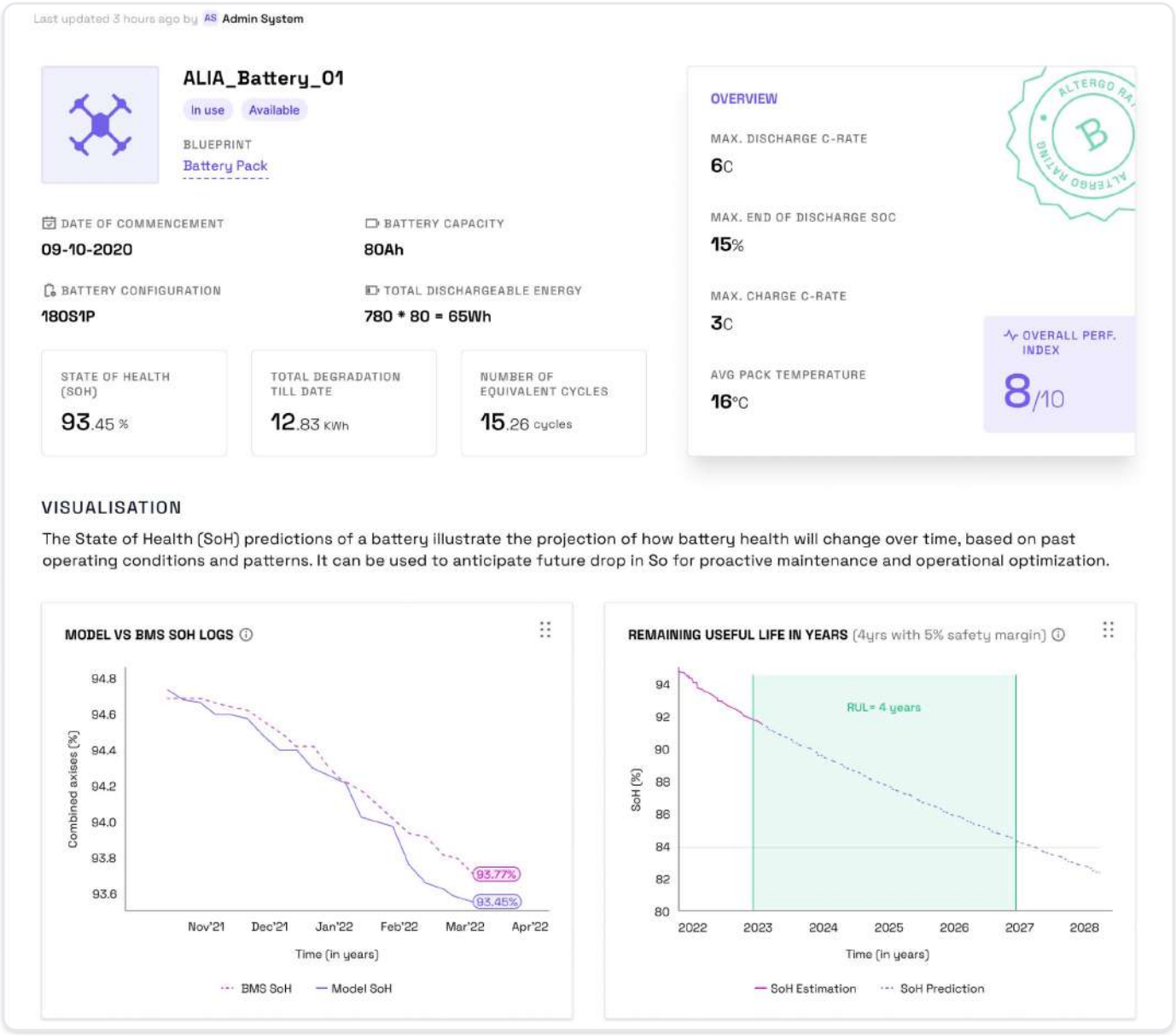
Monitoring Dashboard

ESS Dashboard for comparison of onboard battery pack: **P1:SN9** | **P2:SN10**

Having the data on the platform is only the first step.
We created dashboards to display EVTOL Telemetry for specific missions.
This is very important to the eVTOL manufacturer in order to decrease the time needed to extract insight from test missions to optimize the parameters of the different components on board.

Integrating an automated ingestion pipeline - 3

Out-of-the-box Reporting



The last element of the integration was the Reporting system. As for the other feature, it relies on the foundation of our Universal Data Layer.

Conclusion

The eVTOL manufacturer faced challenges in efficiently managing battery cell R&D data. They needed a software solution to streamline the evaluation process and ensure data integrity for FAA certification.

Altergo's Digital Twin platform addressed this by providing a system for data ingestion from various sources and harmonizing it for visualization.
The platform's digital twin concept stored telemetry data, while the **Smart Ingestor** feature converted diverse data into a universal format. Automated ingestion pipelines with pattern recognition eliminated manual data sorting.

The resulting dashboards provided immediate insights from test missions, leading to a **4X reduction in time** from cell testing to flight.