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LILM.OQ - Lilium NV to Lift the Lid on the Battery behind its revolutionary eVTOL Jet: Webinar and Live Q&A with Co-Founder Daniel

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PRESENTATION

Operator

Good day and thank you for standing by. Welcome to the Lilium Battery webinar. (Operator Instructions) Please note that today's conference is being recorded. I would now like to turn the conference over to your speaker, Rama Bondada, Head of Investor Relations at Lilium. Please go ahead, sir.

Rama Bondada *- Lilium N.V. - Vice President, Head of Investor Relations*

So first, thank you, everyone, for joining us today. My name is Rama Bondada. I'm the Head of Global investor relations here at Lilium. Before we get started, today is Veteran's Day here in the U.S. and I would like to profoundly thank our U.S. Veterans and current members of our military for your service and sacrifices for the country. I joined at Lilium about 2 months ago after spending the previous 10 years on the buy side, primarily in the long only strategies in 5 years as a sell-side analyst covered aerospace and defense.

I started my career as a systems analyst for the F-35 program at Lockheed Martin. And my first 2 months here at Lilium has a combination of drinking out the proverbial fire hose and other things at Lilium but also on a listening tour of investors with shareholders and non-shareholders and our sell-side analysts.

The 3 main consistent areas of questions I received were around batteries, funding and certification. Over the next few months, we will be addressing these areas of those questions. But today, we're starting that process with this webinar and batteries, which will be followed by a Q&A session.

As a reminder, this presentation will include forward-looking statements within the meaning of the United States Federal Securities Law and are subject to risks and certainties and other factors that could cause Lilium's actual results to differ materially from such statements. Please refer to the cautionary statement regarding forward-looking statements in our presentation and the risk factors discussed in our filings with the U.S. Securities and Exchange Commission for more information on these risks.

Before we get started, I just want to reiterate our guidance we provided along with our first half 2023 results filed in September with the SEC and our last shareholder letter. We are reiterating that guidance. But I'd also like to add some color. We guided to second half cash spend of approximately EUR 170 million or $185 million. We're trending certainly below that amount as of now. So this should help you calibrate where we'll be at year-end on cash.

I should also mention that we have already announced predelivery payments, PDPs so far this year, and we expect increased momentum on that front with the eminent start of production ongoing progress towards our first manned flight. We had said in the past that PDPs were more of a 2024 story, but it's starting a lot sooner than we had expected.

So this is our agenda over the next 35, 40 minutes. And these questions in the agenda are the same ones that I've come across most often. Our goal after answering these specific questions is that you will have clarity on the power and energy requirements for the Lilium Jet and how those requirements are being validated and proven and also proof that our cell design and battery performance meet these requirements currently and that there are other options in the battery market available as a contingency.

We'll discuss how these batteries are safe for aerospace usage and how we have been testing them for safety. We'll share with you our plan to prepare the supply chain for our production ramp. And finally, we hope that you'll come away with the high-level understanding of our road map to increase the Lilium Jets range beyond the current expected operating distance of 175 kilometers or 110 miles. And what is a very unorthodox approach in order to give comfort to the investment community and to provide a broader clarity and transparency. We're releasing and sharing some of our flight test data battery information, which we have never shared before. This presentation is presently available on Lilium's website. Some of this actual information and data we'll be sharing with you today and will be or is already part of our certification submissions to EASA.

Before I hand it over to Daniel, I'd like to bring your attention to our announcement today regarding our strategic partnership with InoBat whose largest shareholder at 25% ownership is Gotion Hi-tech. Gotion Hi-tech is one of the largest producers of lithium batteries in the world and is contracted to supply up to 80% of Volkswagen Group's battery needs. Volkswagen Group is Gotion High-tech's largest shareholder. InoBat will begin producing our battery built on Ionblox technology in early 2024 at one facility in Slovakia. This is a second potential source of battery manufacturing for us, creating the redundancy with our existing alliance with custom cells. Furthermore, our agreement with InoBat could be extended to incorporate battery cell technology from InoBat and its parent company, if needed.

Given the existing manufacturing agreement with InoBat, this would not be materially -- material to our certification or industrialization process. This is a key step to derisking our battery and battery manufacturing process. Later in the presentation, we'll go to more detail about our InoBat and Gotion alliance and what it means for our business. So let's get into it.

Our main presenter today is our Founder and Chief Engineer of Innovation; Daniel Wiegand. Daniel is responsible for Lilium's battery road map, including next-generation cells. I would argue there probably is no better person to both walk you through our battery technology needs, our progress and our path forward and also give you the landscape and progress of what's going on with aerospace-grade batteries globally. Daniel, over to you.

Daniel Wiegand - *Lilium N.V. - Co-Founder, Chief Engineer for Innovation & Future Programs and Executive Director*

Thank you, Rama. Hello, and welcome, everybody. Thank you for joining today. Without more words, I suggest we start directly into it. Why does the world need battery-powered aircraft? In aviation, we have 3 sustainable solutions for mobile energy storage, batteries, green hydrogen and e-fuels. It is well known that the primary energy efficiency for battery powertrains is around 6x higher than for e-fuels and 3x higher than for green hydrogen. This has a direct implication on energy cost of a flight with battery-powered aircraft delivering lower cost than any other sustainable alternative. Therefore, we believe that any flights that can be done with a battery-powered aircraft will be done with a battery-powered aircraft.

Electric aircraft are limited in range today, but batteries are getting better every year. Hence, we believe, from a technology point of view that by 2050, around 50% of all flown passenger kilometers could be done in a battery electric aircraft. Over the next 1 or 2 decades, we expect 75% of electric aircraft performance improvements to come from the battery. So the battery is the performance driver in an electric aircraft. The 2 key aspects here are power for takeoff and landing and energy for the range. Beyond that, every cell design is a compromise across many competing aspects such as safety, cost, cycle life recyclability and many other factors.

As a short recap, the key differentiators of our Lilium Jet are the largest cabin in the sector with clear premium positioning and aesthetics with $2 per passenger kilometer, we have low operating costs that even includes margin for an operator and we focus on regional missions. And beyond that, on the technical side, of course, we are highly differentiated, developing the first eVTOL aircraft using electric jet engines. 95% of all aircraft on the globe use jet engines. And I'm quite sure if you have flown turboprops, you know from your own experience why passengers prefer jet aircraft. They fly faster. They have lower noise emissions and vibrations in the cabin they are and feel safer. They clearly have better aesthetics. And on top, they are simpler as they don't require variable pitch on the blades.

However, jet engines are also well known to require more power at takeoff and landing. So let's look into quantifying this disadvantage and evaluate whether the benefits still outweigh the disadvantage. To get going, we need to understand the concept of disc loading. Disc loading is the weight of the aircraft divided by the total cross-section of all propellers or engines.

And what you see on the left is a graph drawn up by NASA around 20 years ago, showing the hover efficiency of various aircraft types, depending on their disc loading. This is applied physics so this graph does not change just like gravity or the earth surface or pie does not change. In general, the rule applies that the lower the disc loading, the lower the aircraft power consumption in hover flight but also the higher the disc loading, the faster the aircraft flies.

You can see that a helicopter has the lowest disclosing among traditional aircraft with around 25 kilograms per square meter. On the other side on the right, a direct lift aircraft, such as the F-35, is operating at roughly 1,000x higher disc loading since it is a high-speed aircraft. Now we will use this chart to get an idea of the power consumption in hover flight in a very simple way.

Our aircraft is using jet engines, and it has a disc loading of around 1,150 kilogram per square meter. We go into the chart and obtain a lift efficiency of around 1.7 kilograms per kilowatt of shaft power. Now we invert this value to obtain shaft specific power. We divide by the electric powertrain efficiency to obtain specific electric power and we multiply with our aircraft weight to finally obtain the total electric power draw of 2,147 kilowatts.

Now let's do that very same exercise for a propeller based eVTOL which typically has around 60 kilograms per square meter disc loading, and we get 1,014 kilowatts.

Conclusions from this slide, our aircraft draws twice the power in hover than the propeller-based eVTOL. We've heard people out there stating that our aircraft would draw 5 or 10x more power in hover than a propeller aircraft. A simple glance on this chart, which you can also find on Wikipedia, by the way, puts these statements into the land of mist. But before just accepting those values, let's check how they compare to power measurements from our real-life flight testing with our demonstrator aircraft.

On the left chart, you see the measured specific electric power of our demonstrated aircraft in a pure hover flight mission. This is the first time we are publishing this data. Now we can take the specific electric power consumption measured in hover flight 0.62 kW/kg we multiply on the right side again with the weight of our aircraft, and we are getting the power consumption based on real flight measurements. What you can conclude from this slide is that our flight test results show slightly lower power consumption than what we got from the NASA paper.

But overall, the simple approach of the NASA paper predicts power very well. I will use the high power consumption value from the NASA paper throughout the rest of this presentation to be conservative and also account for example, for flight in higher altitudes. Also, it is important to note that all our mission profiles and range estimates are based on the fully loaded aircraft. So with the full weight, we are flying those missions.

What I have just done is an ultra-simple approach to demonstrate power consumption, which you can easily follow in a presentation. Of course, our engineers are using far more sophisticated tools to calculate the power consumption of our aircraft. We are following the principle of evidence-based engineering at Lilium. This is the same approach which allows the major aircraft OEMs to predict fuel consumption of their aircraft with an error of less than 1% before they actually fly. What we need for certification of the aircraft is a validated aircraft performance model, which accurately predicts flight physics of our aircraft in all flight conditions. This includes, for example, failure cases, the full speed envelope, altitudes, temperatures and maneuvers. To get it, it all starts with simulations.

Based on those simulations, we design a first loop of our aircraft and systems. Then we did 4 years of flight testing and a total of more than 5 months of wind tunnel testing to obtain real-life data with which we can calibrate and validate our simulation tools. Additionally, we measure compressor maps, motor efficiency charts and we do battery characterization. Then we take all this data and integrate it in an aircraft performance model which is validated by real-life data and which can be used also for certification.

All our power profiles and mission profiles, also those in this presentation, are based on this validated aircraft performance model. And you can imagine, as we use this model for both certification purposes, but also to make performance guarantees in the binding contracts with our customers, the rigor that goes into it is incredibly high.

This is the power consumption profile of a long-range mission of 175 kilometers as it now comes out of our validated aircraft performance model. You can see a short high-power peak for takeoff. Then power quickly drops during transition flight and you can see the climb phase, the steady cruise flight in the middle and the decent in cruise where the power draw is close to 0. Then in transition back to hover, the power quickly increases again until touchdown of the aircraft.

The surface under that curve in this chart represents the energy consumed. The hover face in this mission makes around 9% of the total mission energy. A propeller eVTOL would only reduce hover energy by around from 9% to around 4% as it consumes half the power in hover flight. However, our engine cross-section is better sized for efficient cruise flight and we are significantly more efficient than propeller-based eVTOLs in cruise flight.

Overall, Lilium's Jet consumes less power for long missions. The increased power consumption in hover is more than compensated in cruise flight. On top, we are flying significantly faster in our long-range mission compared to our peers. Hence, our aircraft is ideally suited for regional missions and the better batteries get the bigger our advantage becomes.

Now we shift our focus to how the battery cells provide this power and energy. The power consumption in hover flights divided by the total mass of battery cells in the aircraft gives us the specific electric power withdraw from the cells in hover flight.

The chart on the right side shows a measurement we did 2 years ago on the continuous power capability of our cells. So the chart shows us how much power the cell can provide at different states of charge and at 30 degree celsius. And this is actually conservative since those cells produce much more power even when operating, for example, at 45 degrees or when power pulses are shorter. If we now insert the specific electric power values from the left side, the chart shows us that our cells can provide sufficient power for hover flight down to a state of charge of less than 20%.

The last 20% of the cell can then be accessed with a forward landing only, and they serve as an operational reserve. It is interesting to see that for higher charge states, the cells can provide way more power than we actually use.

So there is plenty of margin in the higher charge states. What you can conclude from this slide is that our cells in the production aircraft are able to provide sufficient power without problems. And this is one of the key slides you need to understand to gain conviction about our aircraft feasibility. In contrast to what I've just shown, we have heard concerns that our aircraft would be dependent on battery technologies half a decade away. This is obviously wrong. In fact, we have done 4 years of flight testing with full-scale demonstrators and all of our demonstrators have been flying with off-the-shelf batteries using standard lithium-ion chemistries. In 2019, we flew our Phoenix 1 demonstrator first time, and the cells in the pack were the LG HG2 cells which were designed already in 2013. It's a well-known 18650 cell, which you can actually buy on Amazon.

In 2021, we then flew the second generation of our demonstrator. And again, we used a standard lithium-ion chemistry with a graphite anode. This time, we were using a KOKAM cell which were originally designed around 2015 for forklifter applications. The battery pack in this aircraft was also the first flying prototype we had which fulfills the full fire containment requirements from FAA. So we have 4 years of flying proof that standard lithium-ion chemistries can provide the power we need for flying this aircraft configuration. The reason we're using lithium-ion cells with higher silicon content for our entry into service aircraft is our regional business model. We simply want more range.

This is the cell, which will actually go into our conforming aircraft, which we are building right now. It is a lithium-ion cell, which was designed by our technology partner, Ionblox in the U.S.A. We are invested in Ionblox alongside our co-investors Temasek and Applied Materials. Ionblox have developed one of the best silicon anodes for lithium-ion batteries, which can be mass manufactured. The anode is silicon dominant, which means roughly 1/2 of silicon and the other half is other components. The silicon in the anode is the reason why this cell achieves higher energy, higher power and why it has higher fast-charging capabilities than cells with standard graphite anodes. The cathode is a standard NMC811 cathode. This is the #1 cathode chemistry you can find in automotive cells these days. The cell is being produced by custom cells here in Germany.

Now let's put this cell into context of what you can find in the market. Energy and Power are always a compromise in a cell. You can either find high power cells, such as the Swaytronic, which provides 3x the power of our cell or you can also find high energy cells, for example, the ones from Amprius or CATL, which have announced more than 50% more energy than what we have in our cell right now. To visualize this, we've drawn this blue dash line here in the chart and if you are left of that line, you are probably asking for a feasible combination of power and energy. If you're on the upper right corner of the chart like a little unicorn, then you're probably a miracle for now.

What we can conclude from this slide is that our cells are perfectly in line with what you get from other high-performance cells. We are not alone using silicon anode cells, in fact, it is widely recognized that silicon anodes are the next step in lithium-ion batteries in automotive. There's a great article from IEEE spectrum explaining why silicon is the next big thing in lithium-ion batteries. It enhances energy, power and it also allows fast charging without cycle life degradation.

For those reasons, for example, GM, Porsche and Mercedes have all announced premium cars for the time frame 2024 to 2026 using silicon anodes like we do. Tesla, of course, have also announced the green silicon into their cells. So by the time our aircraft goes on the market in 2026, our cells chemistry will be the state-of-the-art in premium automotive. But this also means if you come on the market in '26 with an electric airplane using graphite anodes, you are using a data technology that is no longer competitive.

Another question we sometimes get is that people say, isn't the power draw growing tremendously in failure cases. Of course, our engineers have thought extensively about this, and we wouldn't obtain a certification if we had no answer on this. To mitigate this problem, our aircraft has 10 independent battery packs. If one of them fails, the remaining packs need to provide only 11% more power. This is in line with what the cells can produce in an emergency. We always take worst-case failures into account in our design and we have tested the power increase resulting from all kinds of aircraft failures on our cells.

Another question we've received often is whether our battery pack will become too heavy once certification and safety requirements are incorporated. Well, we have already incorporated all safety requirements into our current battery pack such as crash protection, fire containment, flight loads and redundancy. We had to since this battery pack goes into our conforming aircraft. The first pack in which we had incorporated full fire containment was the Phoenix 2 battery, which flew in 2021.

Since then, we have done several years of flight testing with this technology. And those tests have confirmed that our design is compliant with the regulation. Another question we hear often is what is the reserve concept you are using? And what is the resulting operating range, which is left using this reserve concept? On the European side, EASA have formally released an operating reserve concept called Part IAM, which is applicable to our aircraft.

Part IAM is a performance-based framework. There is no specification whatsoever for hover time. All our operating range estimates and our aircraft design are based on the EASA Part IAM reserves concept. This reserve concept is stricter than any other operating framework for helicopters, for example, since it mandates landing on a VertiPod in all cases, even the most critical failures.

On the FAA side, there have been some wild rumors that the FAA may require a 2- to 3-minute hover requirement. This is completely and unequivocally false. The FAA put out a SFAR in June 2023 and opened it up to comments from the public. There is not even a single mention of hover requirements in the whole document. The link to it is on the page here, so you can see for yourself. And the only mention is a 30- to 45-minute energy reserve. It is clear that eVTOL operations become problematic with 45 minutes reserve. Hence, all of our peers and an overwhelming majority of the aerospace industry have requested for performance-based reserve requirements from the FAA, just like EASA is already using it.

If you go to the link on the page here, you can see and read the comments from all of the various companies for yourself. It is a big advantage for us that our regulator has provided substantially more guidance than the FAA so far. We have a clear and released framework for eVTOL operations in Europe. And here is how the European reserve concept works. At first, the applicant needs to define a reference mission and a reference landing procedure. This is represented by the blue [mentioned] here on the slide. The pilot then flies to the landing decision point, which is around 50 feet above the ground. And here he or she decides whether to land or balk the landing.

From here onwards, the reference mission assumes 25 seconds of hover time until touch down in B. The Part IAM reserve now prescribes that after touch down in B the aircraft must still have an additional 10% of the total trip energy available in reserve. This is shown in the yellow line here.

This reserve equates to an additional roughly 45 seconds of hover time, which means the total available hover time is around 1 minute and 10 seconds for the pilot. If the pilot decided at the landing decision points to balk the lending, she can fly away and has always around 30% of the total battery capacity available to fly to a runway and do a forward landing. This is represented by the red curve here in the chart, and it's called final reserve in the Part IAM concept.

All our operating range estimates are taking this reserve concept into account. To validate the reference landing procedure, we are using, again, a best practice aerospace approach. We have a mixed reality 3D simulator with a fully representative cockpit and a full motion platform. This simulator contains the validated controllers and flight physics from our certification aircraft models. We can simulate wind, rain and night conditions in various combinations.

In this simulator, we have developed our reference landing procedure and we have tested it with more than 750 landings with multiple pilots. We have also developed some landing aids, which make it easier for pilots to consistently land the aircraft with our landing procedure. The result is that pilots can consistently execute the reference landing procedure as requested by the regulator. This is a great testament to how well our pilots and engineers have optimized the handling qualities of the aircraft and the landing aids as well as the total procedure.

Another question we sometimes get is whether we've tested these full flight profiles also on our cells. Of course, we have. On the left chart, you can see the minimum voltage of our cells at the end of landing for different mission lengths using our reference flight profile. To test this, we simply run the same flight profile again and again and each time we extend the length of the cruise flight segment until we violate the minimum voltage of the cell at the end of the flight.

In those tests, our cells achieve more than 190 kilometers range with full aircraft weight and including 25 seconds hover at the end of the flight. Then we subtract the 10% Part IAM reserves to obtain our operating range of 175 kilometers. What you can conclude from this slide is that the cells achieve the operating range plus reserves in tests with real flight profiles.

Some people also have repeatedly questioned the cycle life of our cells since new high-performance chemistries actually often have great performance, but reduced cycle life. And in our case, we specifically picked this technology here because it yields exceptionally good cycle life. Here, you can see a cycle life test with our cells from 1 year ago which we conducted at Idaho National Laboratory. The procedure was 100% full charge and discharge over 1 hour each. This is a very common test in the battery industry because it allows comparison between different types of cells. The result was that our cells retained 88% of their original capacity after 809 full cycles.

This is an exceptionally good result and it surpasses many standard chemistry cells we've been working with so far. There are chemistries out there which yield even higher performance than this one here, but we have so far not tested one which achieved a similar good cycle life at the same time. A concern which our engineers had was whether repeated fast charging in the operations or the high-power pulses during takeoff and landing could significantly reduce the cycle life of the cells. So we came up with a heavy-duty test using a flight profile in which we continuously fast charge the cells and fly the aircraft with maximum take-off mass in mid-range missions. And additionally, we did not actively cool the cells.

The result was that they achieved 1,450 midrange flights with fast charging and they still had 80% -- 88% of their capacity retained, an amazing outcome. For comparison, our business case currently assumes 800 flight cycles only. So there's plenty of margin on the cycle life. But why did the cells achieve even more cycle life in flight cycles than in the standard test. Our interpretation of the results is as follows. The fast charging doesn't really harm silicon anode cells. The big advantage is that they can handle much faster charging without damage. The high-power draws in takeoff and landing were already carefully mitigated by Ionblox in the cell design. The cells have opposite sided taps and they are electrically symmetric on the positive and negative side. This completely avoids hotspots in high-power operations.

Now what really increases the cycle life is the fact that in the flight missions, we are landing with around 30% energy left in the cell. And this means we are avoiding the discharge down to 0, and this is really what increases the number of flight cycles here in this test. We have now extensively discussed performance and cycle life of the cells. Let's now shift to industrialization and supply chain.

Our cells are being produced at custom cells in Germany. Custom cells started production of cells for us in 2021 and meanwhile, they have a dedicated production line for Lilium equipped with state-of-the-art equipment for automated cell manufacturing. They are shipping cells on a weekly basis to us and they are ensuring compliance with aerospace traceability and conformity standards.

At the moment, both custom cells and us are laser-focused on ramping up production rate and continuously increasing quality and yield off the line. But why are we able to produce these new cells with automated equipment already? Well, the answer is very simple. 30 out of 31 production steps are the same like for any other lithium-ion battery, and this allows us to use standard cell production equipment. This is a big advantage of the chemistry we've chosen. One of the biggest problems with novel chemistries is often not the performance but they require new production processes or new supply chains for raw materials. And we have very carefully selected our technology to avoid those risks.

And even for the one novel step, the pre-lithiation, we are using a simple calendaring process for which automated machines are available and which is expected to be very scalable. Pre-lithiation means you are adding additional lithium to the cell during production. So how does that work? We are buying a plastic foil from applied materials, which is coated with lithium. This lithium foil gets pressed on the anode of the cell in the calendaring machine and the lithium then transfers from the plastic foil into the anode.

Applied Materials have been a great partner on this for several years, and they are also an investor in Ionblox alongside us. The pre-lithiation of the cell increases capacity and it also improves the cycle life of the cell. It's a process which is currently being implemented for many high-performance cells in the automotive sector. Our primary cell production partner, CustomCells, has consistently increased output and quality over the past year.

But since batteries are a critical component, we are derisking our battery production with a multi-sourcing approach. As mentioned earlier by Rama, we have extended our existing partnership with InoBat to prepare large-scale production of our battery cells, hereby InoBat is being supported by its investor and partner Gotion. Gotion is one of the world's largest battery manufacturers and VW is the largest shareholder in Gotion. Production of Lilium cells at InoBat's existing facilities in Slovakia is due to start in early 2024.

InoBat will also build Lilium cells at its huge giga factory, which they are jointly setting up with Gotion in Slovakia. This factory will have up to 4 gigawatt hours of production capacity, and it enables scaling of our business significantly.

As shown in this presentation, our market entry cells are working and we have the supply we need. But this is just a starting point for us. We want to continuously extend our lead on battery technology. Our aircraft is designed such that we can upgrade the battery packs without changing the aircraft. Similar to VW, we have defined our own unified cell format with which we are working on a road map of cell performance upgrades while still using existing manufacturing lines and partners.

In a first step, we keep our existing chemistry, and we only make mechanical improvements to the cell overhead. This enables around 200, 350-watt hours per kilogram. And in the second step, we still exploit our existing silicon anode technology and pair it with a high nickel cathode. This enables up to 400-watt hours per kilogram. Both the mechanical improvements and the high nickel cathode are becoming state-of-the-art in automotive during the next 3 years. So our advantage is that we already have a mature silicon anode, and we can continuously improve performance in the next years with low-risk technology bricks.

Where are we heading to in the future? We are globally by far, the most advanced company in design and certification of an electric jet aircraft certified against the same safety standards like a commercial airliner. So we are best placed to lead electrification of regional aviation by applying our technologies and know-how also to larger aircraft platforms. These will be both eVTOL jets and conventionally taking off and landing electric passenger jets. What you see on this slide here is how the operating range of eVTOL's and conventional electric passenger jet improves over time. If you assume a 4.5% energy increase per year, for the battery cells. This is attractive in 2 ways for us. It squarely increases our market size and sustainability impact, but battery upgrades to the existing fleet are also a strong revenue stream for us.

So just to summarize the main points for today. You now know the power requirements of the Lilium Jet, how they have been measured and validated. We've seen measurements of our cells showing that they handle these requirements very well. We've explained regulators reserve concepts and shared measurements of our cells, confirming 175 kilometers operating range with those reserves taken into account.

We have shown how our landing performance has been validated and that our cells have plenty of margin on cycle life. Last but not least, we've shown that we have derisked production and supply of these cells in existing lines and a multi-sourcing strategy with strong partners. The battery cell technology, we selected strikes a great balance between performance on the one side, but also low-cost production, available materials and high cycle life on the other side.

Our aircraft and cell technology are driven by our focus on the regional business model, where time savings are much larger than in urban air taxi applications and the TAM is larger than for urban air taxis as well. In this big market, we are clearly leading the group with our cell technology, our jet aircraft architecture, the 6 passenger cabin and the industry-leading low operating cost.

To conclude on this presentation, the battery dominates the performance of an eVTOL. Hence, over the last 4 years, we have continuously invested and built an edge in this field. And we are convinced the battery has turned from a challenge to being a clear competitive advantage and a moat to our eVTOL technology. And with this, I'll turn it back to Rama now.

Rama Bondada - *Lilium N.V. - Vice President, Head of Investor Relations*

Thank you, Daniel. Ladies and gentlemen, I hope we were able to answer your questions in regards to our battery for energy and power needs, how we drive this and improve it. And the progress we've made in our battery industrialization as production on our first aircraft is beginning imminently. So at this time, let's open up the line for questions. Operator?

QUESTIONS AND ANSWERS

Operator

(Operator Instructions) We are now going to proceed with our first question. And the questions come from the line of Austin Moeller from Canaccord Genuity.

Austin Nathan Moeller - *Canaccord Genuity Corp., Research Division - Analyst*

For each of the battery iteration improvements in 2026 and 2028, we should expect that you'd probably need to get a supplemental type certificate to actually incorporate that in the aircraft, right?

Rama Bondada - *Lilium N.V. - Vice President, Head of Investor Relations*

Thanks, Austin, for your question. Daniel, you want to take this?

Daniel Wiegand - *Lilium N.V. - Co-Founder, Chief Engineer for Innovation & Future Programs and Executive Director*

Yes, really good question. So you don't have to certify the whole aircraft again. But obviously, you have to requalify the battery pack with those new cells in the pack and go through the same testing of the pack which we have -- which we're doing right now and which we are doing in the certification over the next 2 years, yes.

Rama Bondada - *Lilium N.V. - Vice President, Head of Investor Relations*

So basically, going back to that question, Austin. So that's a big part of our business model is that we're looking to capture the aftermarket. So as we upgrade these battery packs you don't really change the structure of the aircraft, you update a little bit of the software, you have to recertify the battery packs, but the battery cell is upgrading the range. And that little bit of power increases our range substantially. And then also, as these battery packs need to be replaced every so often, particularly for fleet aircraft, it opens up our aftermarket opportunity. And I think most people understand that aftermarket margins were substantially higher than OEM margins traditionally.

Daniel Wiegand - *Lilium N.V. - Co-Founder, Chief Engineer for Innovation & Future Programs and Executive Director*

And what is new here is obviously that in an electric airplane where you can do upgrades to the range the residual value is not going down necessarily like on a normal aircraft, but it goes up in the first couple of years as the range increases for the aircraft.

Operator

The question come from the line of Bill Peterson from JPMorgan.

William Chapman Peterson - *JPMorgan Chase & Co, Research Division - Analyst*

Thanks for doing this call and sharing all this information here. I had a question on CustomCells. So for the -- I guess, the '26 time frame, is the cell design fixed at this point? Or is there more development work ongoing and I guess what is the team doing to confirm the performance and reliability across, say, thousands of cells. I can see the cycle like you're sharing, but obviously, repeating that high volume will be key. And then I guess, at least to the extent you've seen it, how much failure mechanisms or how many failures have you seen due to swelling -- just want to kind of try to see how repeatable your cycle lifes and safety and swelling will be and where we are in terms of production maturity.

Rama Bondada - *Lilium N.V. - Vice President, Head of Investor Relations*

Great question, Bill. I'm obviously going to hand that over to Daniel.

Daniel Wiegand - *Lilium N.V. - Co-Founder, Chief Engineer for Innovation & Future Programs and Executive Director*

Bill, good question. So let me maybe start with the cells. So the cell for the conforming aircraft is frozen. This is the cell that is being produced in Tübingen at CustomCells, and it's a cell that you also saw in the video here. And the focus here is to continue to increase the yield of the line to increase the quality and the speed. Obviously, right now, we only have demand for cells, which is relatively limited because we need cells only for testing and for the first 6 certification aircraft, but then obviously, later, the amount of cells is going to ramp up steeply.

We are, as mentioned in the presentation, we are continuously working on improved versions of the cell. We have not finally decided which combination of improvements, we will then bring into the next cell, but the one for the conforming aircraft is frozen.

Now you had asked about swelling, that's a great question because the key challenge that you have to solve in achieving cycle life with a silicon anode is the fact that if you cycle or if you charge a silicon anode cell, the silicon is swelling by up to 300% if it's pure silicon. And to mitigate this problem, different companies have found different solutions. I think Ionblox have found an amazing solution, which you can see here in the cycle life results.

The final cell in our case is breathing by around 3% in one cycle only. And over the entire lifetime, it's breathing by about 10% in total. So we have great technical solutions in their chemistry to mitigate that, I'm not allowed how to tell you all the solutions, but in a nutshell, part of the trick is that the cell is not made of 100% silicon in the anode but roughly 50% is silicon. And the rest is partially porosity and other additives that allow on that very low particle level to deal with the flexibility of the anode.

We have not seen so far failures due to the swelling of the cell at least not that we can trace failures back to swelling of the cell. And this was one of the things we had tested as the very first thing like 3, 4 years ago because obviously, this is what you have to solve in a silicon anode cell. And I can say that at least on our side, the anode and the cell we have here is the silicon anode cell that achieved the best cycle life out of all silicon anode cells we have tested.

William Chapman Peterson - *JPMorgan Chase & Co, Research Division - Analyst*

Great. If I could ask another question. So are you able to share a bit more information on the new partnership with InoBat, but I guess, especially in terms of chemistry, is this also some form of silicon anode, I've seen Gotion talked in the past about semi-solid state but I'm not really sure if you can maybe provide more information. I guess, and also who sort of paying for the development work? Are you -- is there any cost sharing that you're doing with that firm to meet your requirements?

Rama Bondada - *Lilium N.V. - Vice President, Head of Investor Relations*

Yes. So Bill, on the Gotion, InoBat, both production lines, we had mentioned in our press release that we had made a small investment in InoBat but the CapEx for their gigafactory that they plan on building here shortly and Volta I factory already running, and it will be producing our battery starting early next year. That CapEx is -- that's part of the InoBat, Gotion, Volkswagen decision that we're not involved with that CapEx portion. I'll hand the rest of the question over to you, Daniel.

Daniel Wiegand - *Lilium N.V. - Co-Founder, Chief Engineer for Innovation & Future Programs and Executive Director*

Yes. On the technology side, they are producing initially the same cell and the same chemistry but we have already discussed with both parties, InoBat and Gotion. We would also have access to the technology portfolio on their side. And this is very interesting also for the second step on our roadmap that I mentioned here. For example, if you want to pair the existing silicon anode with other technologies. It's very interesting for us to do that.

Rama Bondada - *Lilium N.V. - Vice President, Head of Investor Relations*

And I would add one other thing. Given that all of these gigafactories go up throughout the world, most of them are obviously being used for the auto industry, which is a highly cyclical industry. As we have these stations, eVTOL, in particular, our battery needs are more secular in growth. And so this is a good balance for a lot of these battery providers to have a secular element for their more cyclical battery enhanced. And so we get a lot of lux from many of these providers.

Operator

We are now going to proceed with our next question and the questions come from the line of Savanthi from Raymond James.

Savanthi Nipunika Prelis-Syth - *Raymond James & Associates, Inc., Research Division - Airlines Analyst*

Just on the charging system, are this -- kind of the charging, I wonder if you can talk a little bit about kind of the charging system requirements and if you're planning to build your own there.

Rama Bondada - *Lilium N.V. - Vice President, Head of Investor Relations*

Yes. Great question, thank you. And we were actually kind of hoping we would get this question. So Daniel, I'll let you take that question.

Daniel Wiegand - *Lilium N.V. - Co-Founder, Chief Engineer for Innovation & Future Programs and Executive Director*

Savi, great question indeed. So on the charging side, it is obvious for everybody I think that the industry needs charging standards that applies for everybody because the last thing we want is one landing side where you have 10 different types of chargers sitting around that investments. So for that reason, we have designed our aircraft to be fully compliant with the combined charging standard, the CCS standard, which is well known from automotive. We can charge the aircraft with the 350 kilowatts, 800-volt chargers, you find anywhere in Europe, in the U.S., in other parts of the world.

And we have also, for that reason, jointly offered some papers together with BETA and Archer, for example, because we all pursue here that same standard. And that means we can also, for example, charge a Lilium Jet on a BETA charger produced by them. We don't think it's helpful if individual companies try to pursue their own standard, optimize for their aircraft. I think ultimately, the whole industry benefits the most if we stick to a harmonized standard.

Rama Bondada - *Lilium N.V. - Vice President, Head of Investor Relations*

I would add one thing that given our architecture of our aircraft, our cooling systems and thermal management systems are on board. So we need a lot less equipment on the ground for charging than some other options that are out there. And this is a very huge benefit for us on the charging infrastructure that's needed.

Savanthi Nipunika Prelis-Syth - *Raymond James & Associates, Inc., Research Division - Airlines Analyst*

That's helpful. And if I might also just have you thought about kind of battery afterlife and things like that. just how far -- how long you would -- I know what your -- the capability that you talked today about your batteries are, but just how long you would use them and what the afterlife prospects are?

Daniel Wiegand - *Lilium N.V. - Co-Founder, Chief Engineer for Innovation & Future Programs and Executive Director*

Yes. So we have looked into both a second life of the battery cells and recycling. What is definitely a given for us is that we will do the recycling. And we also intend to do the second life applications as grid storage applications, et cetera. But here, obviously, we are facing a stiff competition in a few years from tons of automotive batteries coming into that market as well into their second life. But this is something that we are very closely monitoring and that is part of our business case and of our plans to especially take it off those two options. By the way, also looking into ways of how we can replace the cells in the aircraft without having to take out part of the battery pack. So there is some interesting technical options as well, which can reduce material turnover and cost.

Operator

(Operator Instructions) We are now going to proceed with our next question. And the questions come from the line of Adam Forsyth from Longspur Capital.

Adam Sinclair Forsyth - *Longspur Clean Energy - Head of Research*

A couple of questions for me. Just firstly, we've had one recently putting export controls on graphite and there's some created, some uncertainty around battery supply material generally. Given that you're -- high value products and to an extent lowish volume product. Do you think you might proceed yourself specifying near sourcing of materials into your battery suppliers. Is that something you would want to do? And then just a little bit more explanation on the relationship with Gotion? I think in the presentation you talked about support from Gotion. Is that anything more than financial? Is there anything technical around that?

Rama Bondada - *Lilium N.V. - Vice President, Head of Investor Relations*

Thanks Adam for your questions. Daniel, do you want to take the first part of the question.

Daniel Wiegand - *Lilium N.V. - Co-Founder, Chief Engineer for Innovation & Future Programs and Executive Director*

Yes. On the raw material side, that's obviously an ongoing concern for everybody around the globe. First of all, I would like to say we do not have graphite in our cells, in the chemistry. So this time, we've been lucky. But next time, it's a different material. And yes, for that reason, we have, especially on the lithium side locked down supply contractually already for a couple of years ahead because we've had concerns on supply and we also try to source, of course, very responsibly with respect to some countries on the planet and we try to source locally.

For that reason, you can see, for example, that both factories, CustomCells is in Germany and InoBat is in Slovakia, which is less than 1,000 kilometers away from us here and this is also one of the reasons why this combination of InoBat and Gotion is so exciting for us because they are really leading -- the Gotion is really leading on technology as a big player in batteries. But at the same time, we have a local factory and the local supplier producing our cells.

Rama Bondada - *Lilium N.V. - Vice President, Head of Investor Relations*

And most of the raw material, the supply chain in general is locked up at this time. I realize we probably haven't announced all of it for various reasons with -- with our partners, but the supply chain is pretty much locked in at this point.

Operator

(Operator Instructions) At the moment, we have no more questions from the line. Therefore, I give back to Rama.

Rama Bondada - *Lilium N.V. - Vice President, Head of Investor Relations*

Sure. Thanks. So I should mention we saw a huge interest in this webinar from retail shareholders. Many questions were sent in, also via the SAY platform. Thank you for your engagement. I think we already addressed a lot of them in our presentation and some of the Q&As from our analysts. But I did want to pick up some of the questions that were voted up so I would like to get to the one that's probably the most, which is how far out is the first production aircraft and when -- and testing to follow. Daniel, do you want to take this question?

Daniel Wiegand - *Lilium N.V. - Co-Founder, Chief Engineer for Innovation & Future Programs and Executive Director*

Yes, of course. So as we previously stated, we aim to start building our first production aircraft, the conforming aircraft in December this year. We actually have started building many components. We've built the first engine. We've built many parts, and we plan to start the final assembly of fuselage and wings in December this year and we are on track for that.

Next year, we will then, of course, continue in a kind of staggered way to build more of this airplane. We expect a total of 6 aircraft, at least in the certification campaign, and there will be then a rollout some months of ground testing and in the second half next year, we plan to do the first flight with a pilot on board of the conforming aircraft.

Rama Bondada - *Lilium N.V. - Vice President, Head of Investor Relations*

So with that, I think we've come to the end of our battery webinar. Thank you again for joining us. I also want to say happy Diwali to everybody. We look forward to speaking with you again shortly and stay tuned. Thank you.

Daniel Wiegand - *Lilium N.V. - Co-Founder, Chief Engineer for Innovation & Future Programs and Executive Director*

Thank you very much.