



Offering ubiquitous mobility, communication and sustainability, the New Sky Economy fundamentally changes how society harnesses the sky. To unlock it successfully, established and new aerospace companies alike will need to reimagine their boundaries.

Aerospace will soon be ubiquitous

Imagine a world where the aerospace ecosystem works together to provide new services that meet the diverse needs of people from all walks of life. That's the New Sky Economy. And it's closer than you think. So, what will it look like?

Meet Layla. She's always on the move for both business and leisure. While she wants the best experience from departure to arrival, she also cares deeply about having a low carbon footprint. Layla will rely on aerospace for sustainable and seamless transportation. All the way from her neighborhood on an eVTOL aircraft straight to the terminal, where she will board a flight to her destination, powered by 100% sustainable aviation fuel.

Now meet Akosua, a mother of four and a community leader for her village in the Ashanti Region of Ghana. As a community leader, she's committed to improving the health and prosperity of her people. Akosua will rely on aerospace solutions for access to medical supplies, transportation, timely crop market data and to bring internet connectivity to her remote village.

Layla's and Akosua's needs offer just a glimpse of the New Sky Economy. But they reveal how the demands on aerospace are changing: from new life-enhancing experiences to the positive environmental impact the industry can make with more sustainable modes of transportation and space-based services.

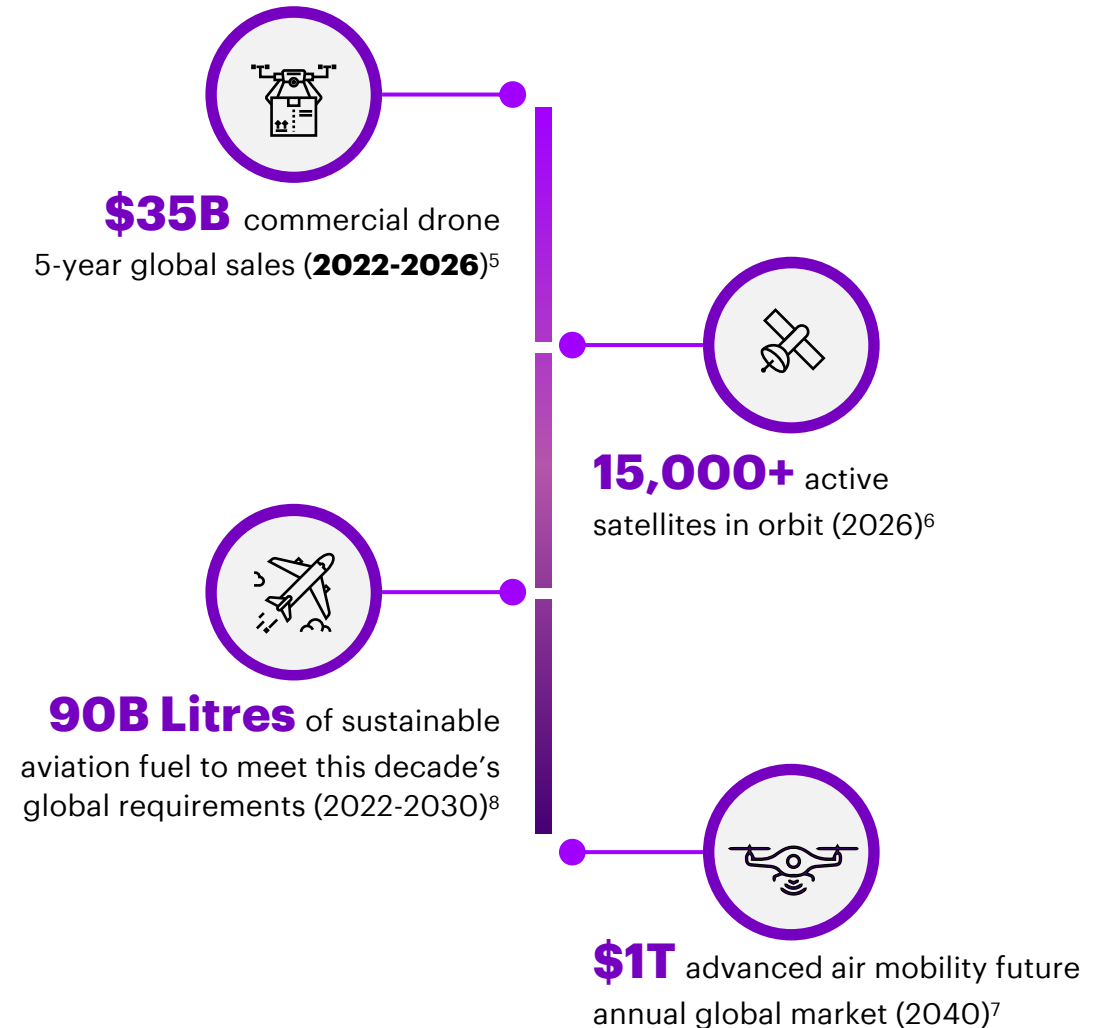


Charting the New Sky Economy

How we use the sky is changing dramatically. This New Sky Economy offers innovations for mobility, connectivity and experience in established markets such as commercial air travel. And it will shape entirely new markets. The commercial drone market is estimated to grow at a 29% CAGR from 2021-2026, reaching \$35 billion in total global sales.¹ Over 15,000 satellites are expected to be in orbit by 2026, with many more to come.² Advanced air mobility (AAM) is arriving soon, with the potential to be a one trillion (USD) market in 2040.³ Sustainable aviation fuel (SAF) requirements are growing at an 83% CAGR (2021-2030) with a total volume of 90 billion liters needed to make progress towards net-zero emissions (Figure 1).⁴ All of these are huge changes for an industry that typically grows at 2%-5% per year.

Any company — established or new — that wants to compete will need to reimagine their own boundaries and develop digitized, nimble approaches for both innovation and certifiable production.

Figure 1: New Sky Economy Markets

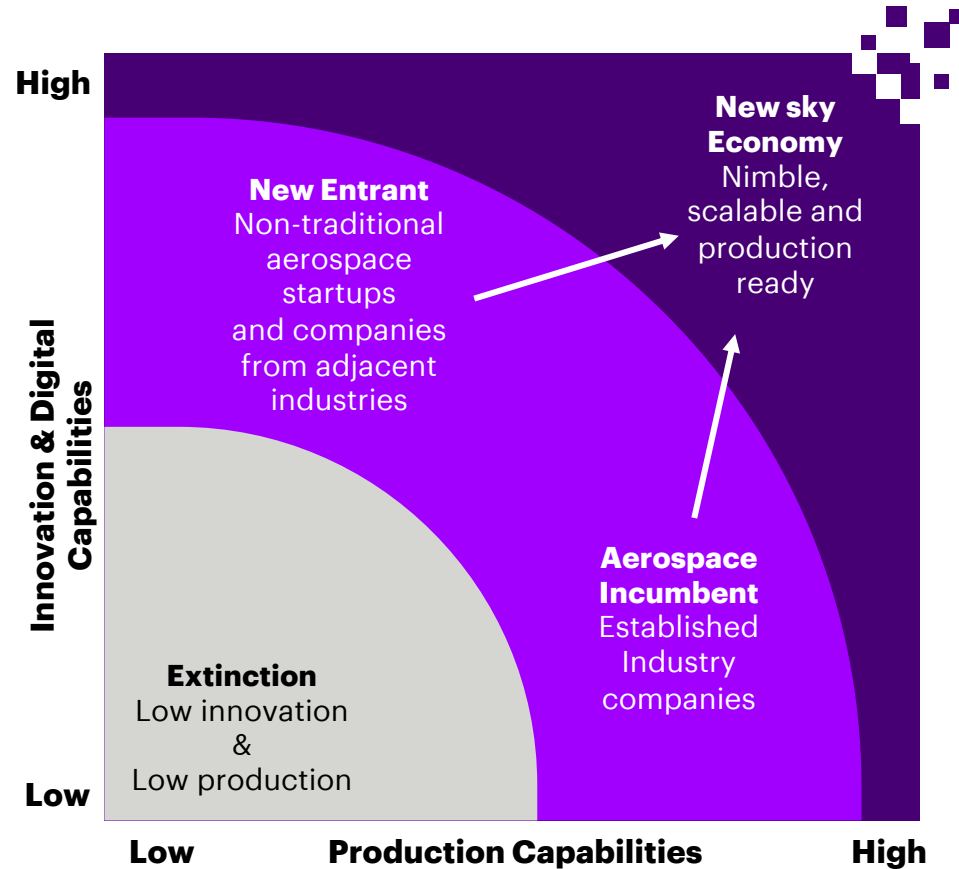


Reimagine boundaries that build upon strengths

Incumbents must strategically reimagine their own boundaries to accelerate innovation at scale. At the same time, they need to maintain certification that allows new, competitive aerospace products to come to market (Figure 2). Doing both means addressing these two, pointed questions:

- 1. How to see past existing operating models, processes and products to take a new view on digital platforms, data and artificial intelligence to operate more like a digital native business?**
- 2. And how to implement new tools, methods and processes to accelerate innovation without major disruption to proven operations?**

Figure 2: New sky economy capabilities to succeed



As new entrants approach the challenge of production ramp-up in the context of either building a long-term business or as an acquisition target (Figure 2), they also need to ask themselves these two key questions:

- 1. What do they need to do to achieve and maintain certification so their products can get to market while maintaining their innovation edge?**
- 2. And how will they maximize efficiency while creating, selling and supporting a physical product, often wrapped with a broader service?**

Incumbents must flex out of their comfort zone

Today's aerospace industry is a vast network of incumbents. These traditional companies' and space agencies' business models, processes and infrastructures are geared to meeting conventional demands. Organizations like Airbus, Boeing and the national space agencies have established certification and proven production capabilities, with experience in aviation and spacecraft operations. However, the New Sky Economy will challenge existing systems, models and processes. They are hard to flex and scale (Figure 3).

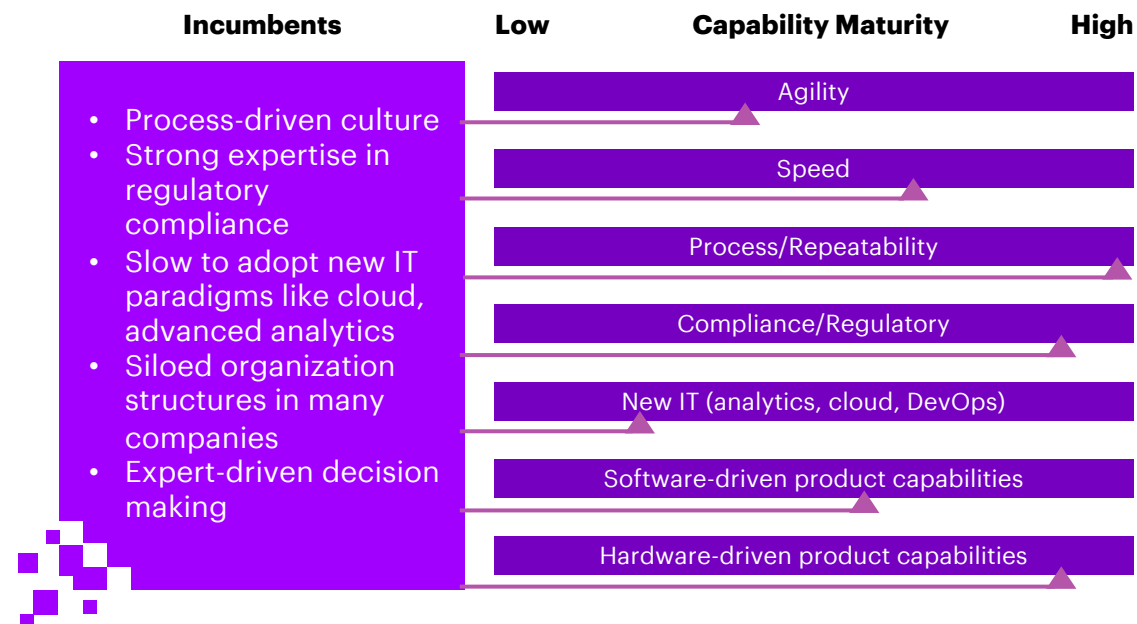
Incumbents need to build upon lessons learned from Model-Based System Engineering and mobilize a model-based enterprise (MBE) approach. This pushes digital models from engineering through to manufacturing, supply chain and support to deliver the speed and agility incumbents need.

MBE by itself is not a silver bullet; digital skills are crucial for the successful innovation and subsequent mobilization of a model-based approach across all operations. By building up their skills, linking relevant data and making systems interoperable, incumbents can seamlessly integrate the tools, methods and information that enable rapid response to change while also making use of the best aspects of a proven organization.

Without a culture of collaboration and silo-breaking from the start, incumbents' engineering and manufacturing will struggle to maintain the speed of innovation that the New Sky Economy requires.

Critically, the shift to a model-based approach is as much about mindset and culture as it is about technology and processes. Once proven at a relatively small scale, an MBE pilot can be followed by scaling to a broader range of products and variants, turning many screws at once.

Figure 3: Snapshot of incumbent capabilities



Flexing comfort zones in action

Boeing envisions the Metaverse as key to improving quality and safety. The north star for its next generation aircraft is to link an aircraft digital twin to the production system.⁹

Airbus Chief Executive Guillaume Faury, a former automobile executive, seeks to "invent new production systems and leverage the power of data" to optimize its industrial system.¹⁰

New entrants certify while scaling up

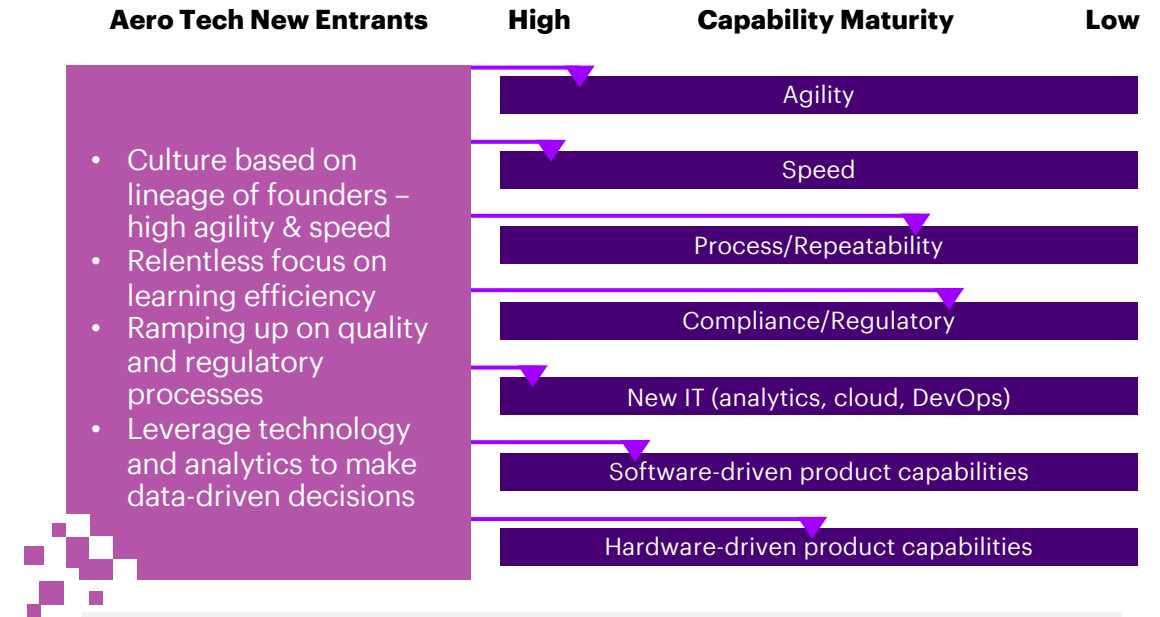
New entrants bring capabilities cut from the cloth of high-tech. Aero Tech companies such as Joby, Lilium, SpaceX, and Project Kuiper, include high-tech spin-offs and companies from adjacent industries, all born on a digital foundation.

As digital natives, these companies are nimble and can quickly adapt to future demands in aerospace. They can also collaborate across multiple industries and participate in the New Sky Economy to address novel and evolving needs. Their startup culture, with its minimal hierarchy and more open communication, is significant here. But the question remains, are they ready to manufacture a certificated product at scale (Figure 4)?

One startup executive told us that new entrants need to be keenly aware of the requirements that come along with aviation.¹¹ And the infrastructure and supply chain required for production at scale are orders of magnitude more complex and capital-intensive than for building a one-off prototype.

New entrants should take a clean-sheet approach to their end-to-end digital systems landscape. This starts with a fully open, digital collaboration platform that unites all functions, processes and data structures in a “town square.” This will enable universal data standards, a seamless digital thread and interoperability between operational functions, right from the concept stage. And it will enable the right information to accelerate product development and continuous, responsive product improvement. New entrants must bring on board experienced aerospace functional talent to operate as a certified aerospace producer.

Figure 4: Bridging prototypes to production



Scaling up in action

Alba Orbital launched 13 PocketQube satellites with five deployers that were 3D printed with a carbon fiber-filled composite material. This approach is not a one-time prototype process, but now routine. The deployers are designed to provide greater access to launching small satellites in orbit.¹²

Archer Aviation is approaching their design for certification speed, ease of manufacturing and high-value flight operations. Manufacturability is focused on using current state-of-the-art processes rather than those such as 3D printing which would require additional regulatory scrutiny.¹³



Data is king, but how to best harness it?

Incumbents' proven operations are often also siloed. MBE helps break them down. Sharing highly detailed information about components and products across business functions and with the supply base, service partners and even customers is vital. Beginning at initial concept – and updated every step of the way – this shared information ensures a component is designed for effective production and long-term service.

MBE increases adaptability and decreases rework, enabling suppliers to “fit check” their components with an original equipment manufacturer (OEM), in real time, before the OEM orders. Using a model-based approach can, for example, enable the rethink of a component's design using parameters beyond form, fit and function, such as lead times for raw materials. This can have a huge impact on the supply chain and delivering on schedule and budget.

Established aerospace firms typically change one screw at a time, to “tighten” the certificated product over time. This reflects the balance of keeping changes safe, while learning, refining and scaling novel techniques. MBE lighthouse pilot projects established to empower model-based approaches are a great place to pressure-test new skills, investigate new techniques learned from the ecosystem and spark a cultural change.

Deployments can start small. A lighthouse pilot can demonstrate its power without impacting business continuity. For example, a Tier 1 supplier has been piloting the application of models well beyond engineering and going through the complete lifecycle of critical component sourcing, product assembly, quality assurance and field maintenance. The key to this pilot is the initial focus on a small, specific new component variant.¹⁴

Take, for example, a turbine component supplier struggling to source the alloys needed for a specific part. By leveraging the product model across manufacturing, engineering and supply chain, it is able to consider alternative materials and adapt the design to use one with significantly shorter lead times.¹⁵

Unlike the incumbents setting up lighthouse pilots, startups are already in an “innovate and iterate” mode. For new entrants, a united, digital town square — including 3D models, bills of material, attributes and routings — will allow a smooth flow of parts through the certification and ramp up phases. That universal thread of product data also enables digital twins of the product and factory early on.

“Enabling the digital twin, simulation and visualization tools help trial all steps in the manufacturing process, even the movements and actions of humans in the loop.”

Manufacturing Leader, Tier 1 supplier

This ability creates a safe space to experiment with manufacturing processes, validate scenarios with outcomes and enhance worker skills as they progress toward predictable and certified production. For instance, predictive simulation tools can work with machine monitoring to pre-detect components overheating, tolerance deviations or cutting tool wear. The machine can automatically measure for tolerance, self-adjust and reset the process for the next piece.

Establishing automation for a shop floor process requires a flexible and iterative approach to try, lean and fine tune. The more that can be done digitally or virtually upfront, the easier it will be to adjust and fine tune. Automation requires a detailed understanding of methods, tools and processes. This understanding comes from a combination of experience and digital validation to continuously refine that experience. Automation can also supplement processes and reinforce worker skills while ensuring production and quality standards. Processes will always evolve and automation should adapt to remain useful and relevant, especially as new products are developed. Automation will be crucial to meet the hyper-speed and growth demands arising in new segments such as unmanned air mobility or LEO satellite communications. New entrants with a greenfield approach, setting up everything from scratch, will have the greatest freedom to address automation.

Through its universal data structure, the town square should also reduce the time and resources required during an intensive trial phase, where everything is typically done physically. And beyond the trial, the universal data structure that underpins the digital twin lays the groundwork for a model-based enterprise as the product matures and production rate increases.

One executive told us how enabling digital twins and visualization tools helps to trial all the steps in the manufacturing process, including the movements and actions of line operators.¹⁶ For example, the Siplan suite of tools can provide process-driven simulation for production, material flow and logistic procedures. Additionally, visual simulation through an advanced 3D graphics solution like Unreal Engine provides a collaborative platform to validate processes and operations for the human in the loop, directly mimicking their movement and action.

“You still have some certification burdens that hinder you from doing it like a Google would or Microsoft in a purely commercial application. But you can still get sizeable benefit from a seamless development chain, with a constant integration and test cycle and a frequent cadence of progress that those two methodologies combined bring you to help with that cost profile and schedule profile.”

Engineering Executive, Tier 1 supplier

Talent to fly in the new sky economy

Introducing new model-based approaches requires incumbents to overcome the urge to have humans in the loop at every step. Maintaining trust in their products while striking the right balance between automation and people is, of course, challenging. As the reliance on digital models and software-driven manufacturing shop floor operations grows, a different set of innovation and digital technology skills will need to come into play across traditional aerospace operations.


To gain a “fast pass” to future competencies such as product data architecture, autonomous robotics and extended reality visualization for shop floor simulation, incumbents should consider partnering with digital-native new entrants. The best results will come from blending talent from innovative new entrants with experts from the established aerospace industry that can look at processes from a different perspective and understand how to leverage the power of the product model across operations.

Boeing recently announced an expanded relationship with a leading cloud provider to create a technology foundation to strengthen engineering and manufacturing processes.¹⁷ Incumbents that try to develop these digital capabilities organically – especially in functions like manufacturing, supply chain, quality, and aftermarket service – may struggle. However, incumbents should focus not only on recruiting, but also on upskilling and reskilling their operational talent to embrace these new tools and model-driven processes.

Incumbents need to cultivate the talent of innovative tech players. Conversely, new entrants that want to operate as a certified aerospace producer must bring on board experienced aerospace functional talent from proven incumbents. At one new AAM company, for example, the technical, quality, manufacturing and operations senior management have all served as senior aerospace experts at major incumbents.


The absence of those experienced executives may stall progress to certified production. That’s been the case for some aerospace new entrants, who’ve seen delays in certification and subsequent push of production and flight dates by several years. Building that experience into engineering and manufacturing teams from the outset is essential. The result? Innovators get the inside track on how to work within the regulatory boundaries and learn from experienced aerospace professionals, while bringing fresh perspectives from outside the industry that will drive innovation.

But bringing in experienced aerospace hires may also drag in structures and processes that will impede pace and innovation flexibility. The solution? Construct teams and hire for talent that can marry the speed of a startup with the controls of an incumbent. To thrive in the New Sky Economy, teams must be optimized to have both sides of the brain – innovation and industry controls – working in harmony.



"It's important to align yourself with the proper people in the industry, that have the experience, where it's a win-win situation, [when] you're trying to develop and push the envelope."

Strategy Executive, Low Earth Orbit (LEO) satellite new entrant



"The challenges that people face in being innovative is probably 80% limited by their people, and 20% by new technologies that need to be developed."

Engineering Executive, Commercial Aerospace OEM

Reach for the new sky economy

As the sky opens to new possibilities, so will the aerospace marketplace. As new technologies come to market, incumbents and new entrants alike will continue to seek new ways to move at a much faster pace to fulfill the needs of their customers and the environment, as in the cases of Layla and Akosua who we met at the beginning. How will companies mobilize their data and talent to successfully play in the New Sky Economy?

While they start from different places, both new entrants and incumbents share the New Sky Economy as a common destination. They both have much to learn from each other as they assemble talent and harness data to develop and launch new products and services that will soon fill the sky.



“I can take someone from the outside and try to teach them about aerospace, what all the limitations are...or I can take somebody from the inside and give them time to think. In the end it's the same amount of time and money. Both can be disruptive and can do something great.”

Engineering Executive, Commercial
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