REACHING NEW FRONTIERS: Mastering Product Development as a Space Industry Startup

DASSAULT SYSTEMES

Launching rockets, satellites, shuttles, and crews into space was the exclusive privilege of wealthy nations and large enterprise companies for decades, but that dynamic is changing rapidly. Today, launches are dominated by the commercial sector, with startups and other small private companies entering the arena. Many of these companies are exploring new markets and applications. Industry experts expect that trend to continue in the decades to come.

Though space is more accessible than ever, industry startups still face numerous challenges as they strive to bring innovative new products to an increasingly crowded, competitive market. The journey from design to production requires solutions and processes that promote efficiency, innovation, and quality while keeping costs down.

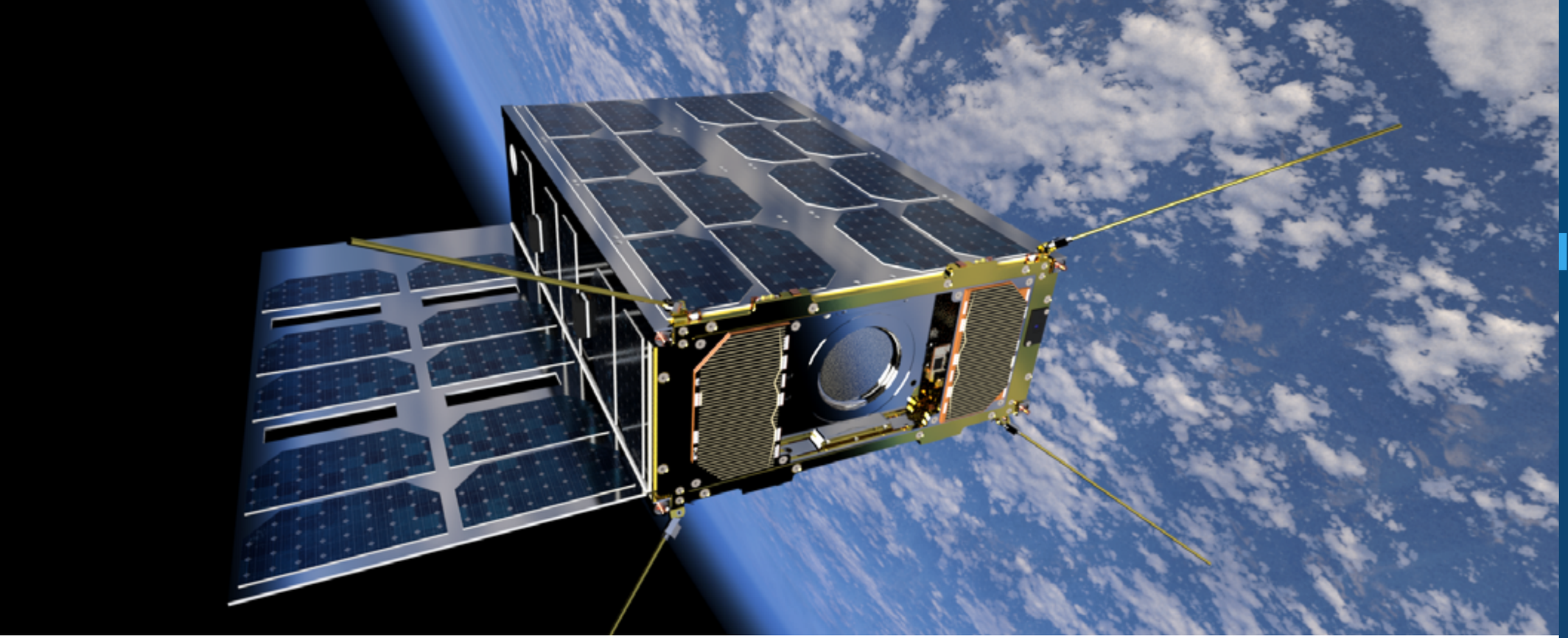
Traditional product development tools often fail to deliver the functionality needed to accomplish this. However, Dassault Systèmes' **3D**EXPERIENCE platform on the cloud delivers the tools today's space industry startups need to create innovative designs, collaborate effortlessly with internal and external stakeholders, virtually analyze product performance in real time, and manufacture products according to their needs.

This e-book explores startups' growing role in the space industry, details the challenges they must overcome to become and remain competitive, and shares how the **3D**EXPERIENCE platform on the cloud can help them do it.

SPACE INDUSTRY DYNAMICS ARE SHIFTING

Since the first satellites were launched in the 1950s, space has primarily been the domain of national governments. Publicly funded institutions, such as NASA, and defense-related agencies have dominated the space industry most of that time. In the last decade, however, that paradigm has begun to shift. Startups and other small private companies are responsible for a growing portion of launches, and the total number of launches rises sharply each year. Consider this: From 2012 through 2021, nearly 5,700 spacecraft were launched worldwide. More than 1,800 of those launches occurred in 2021 alone, and 2022 saw 2,521 additional spacecraft launched.

That these smaller organizations will play a significant role in the space industry over the coming decades is all but certain. The question is, how did these companies suddenly come to prominence in the sector?



NEW INVESTMENT AND ACCESSIBILITY ARE DRIVING CHANGE

One key factor in startups' emergence as serious players in the space industry is the injection of new investments from private sources, such as venture capitalists, private equity firms, and even original equipment manufacturers (OEMs). There's a simple reason: The cost of launching a spacecraft into orbit today is much lower than a decade ago. At its peak in the 1980s, the cost to conduct a launch was just over $50,000 per kilogram. Today, that cost is closer to $3,000 per kilogram and is expected to decrease even further.

As these costs have fallen, space has become more accessible to private companies, and launches have become more frequent. SpaceX, likely the most well known of these companies, has played a significant role in driving down launch costs and increasing launch frequency by developing reusable rocketry. In 2021, they conducted 31 launches. In 2022, that number rose to 61. In 2023, they are targeting 100 launches.

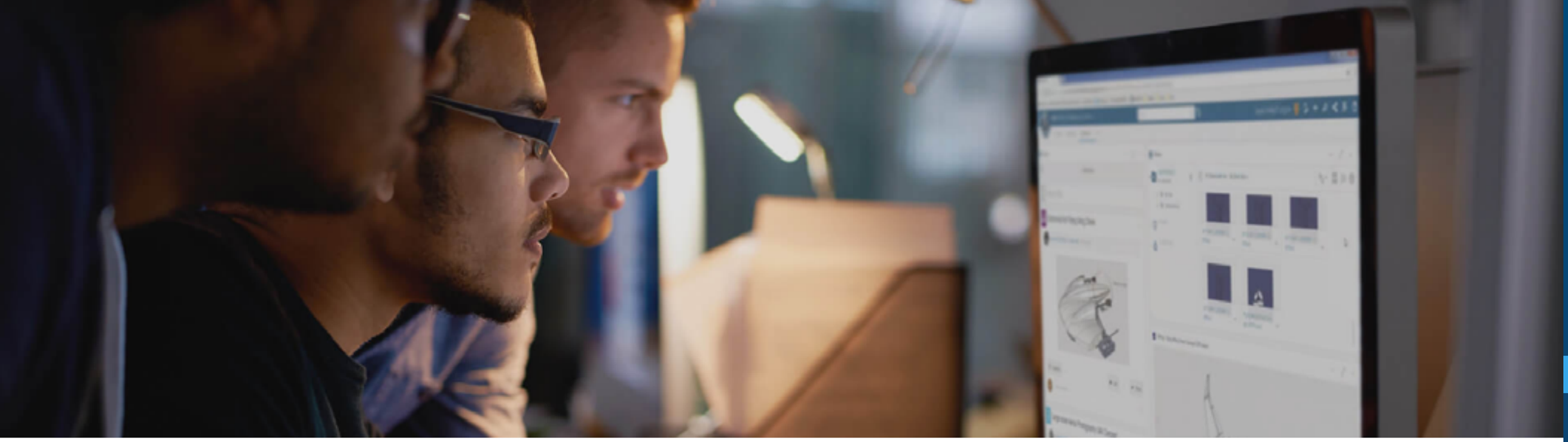
Other companies, such as BlueOrigin, follow a similar blueprint focused on reusability, which in turn drives further innovation in the industry. As these companies' efforts advance, costs will continue to fall, and yearly launches will only increase.

THE RISE OF NEW MARKETS AND APPLICATIONS

As the number of spacecraft launches continues to rise, so does the range and complexity of applications pursued by companies in the space industry. Though many companies continue to focus on traditional applications, such as communication, earth observation, weather forecasting, and research, new markets and applications are emerging quickly, including:

- **Commercial space stations and in-space assembly**. New commercial warehouses, laboratories, and data centers will be assembled in space and will require service and maintenance.
- **Space tourism**. As accessibility to space increases, private and commercial spaceflight will also become more common.
- **Satellite servicing, repair and maintenance**. As satellites evolve, they will be serviced while in orbit (often using other satellites), extending their lifespan and even allowing for mission changes.
- **Infrastructure**. This encompasses equipment related to the launch of satellites and other spacecraft - both terrestrial infrastructure and in-space infrastructure.

Of course, as innovation in the space sector continues, the space ecosystem—and thus the number of markets and applications available to industry startups—will continue to expand. What felt like science fiction only a few years ago may soon become a reality in the near future. Interstellar Lab and YURI are two companies that embody this notion. The former is developing environmentally controlled, closed-loop modules called BioPods that can sustain human life on earth or other planets without outside intervention. The latter is a microgravity experiment specialist that has partnered with an Australian university to send cancer cells to the International Space Station (ISS), where they can be studied in true microgravity.



THE CHALLENGES SPACE STARTUPS FACE

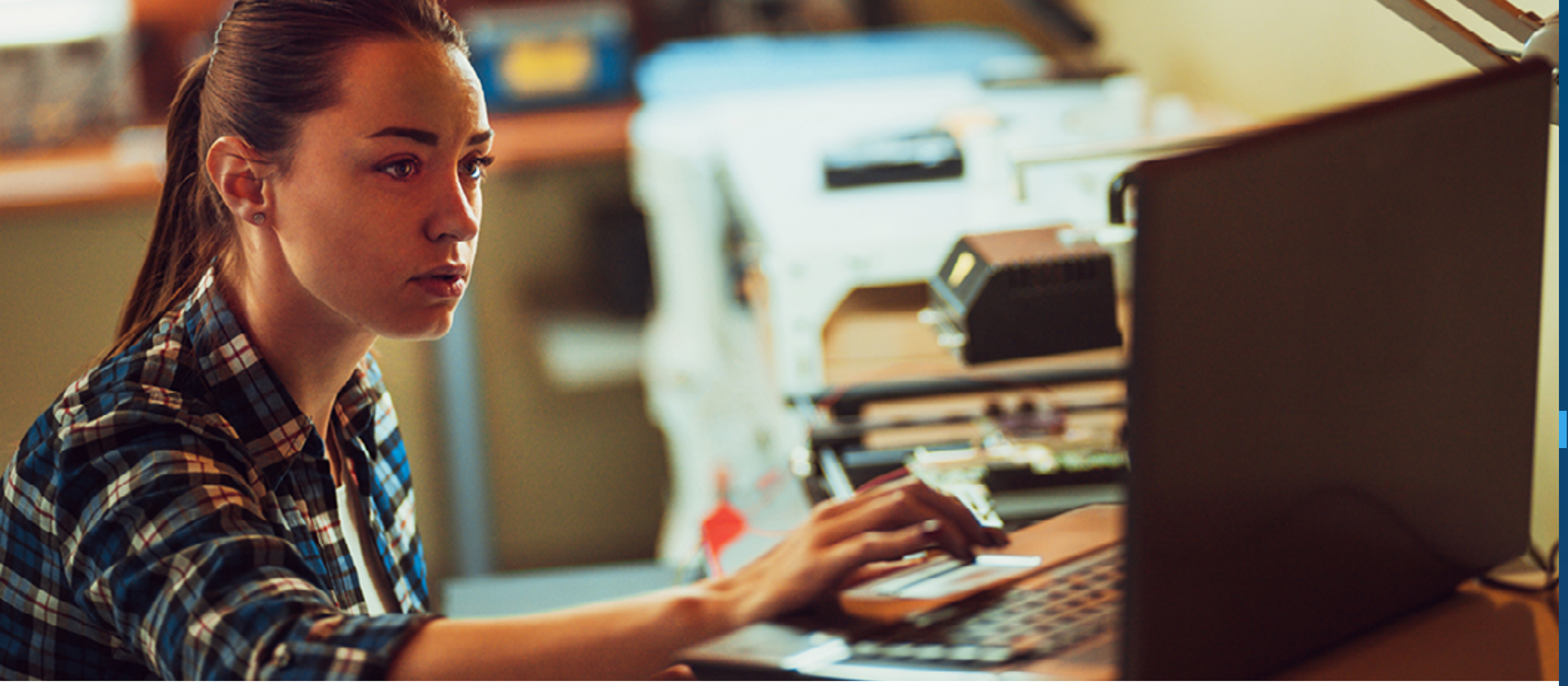
The rapid influx of startups entering the space industry may hint at an exciting future, but it has also increased competition and made it more important than ever for young companies to address their most pressing challenges. One of these challenges is bringing new products to market quickly, which requires companies to shorten development cycles without sacrificing quality. But the inherent complexity of their projects makes this difficult.

Space industry startups must integrate work from mechanical, electrical, and software engineers, often completed in siloes. Failing to coordinate that multidisciplinary work early in the design process increases the likelihood of design errors, which may not be discovered until the prototyping and testing phase. The specialized modular containers YURI creates to facilitate microgravity experiments illustrate these risks. These containers are uniquely designed for different use cases, such as cell cultures, plants, or aquatic systems, and they must fit tightly alongside each other in confined spaces. Even minor design errors can render them unusable and necessitate significant rework.

For many companies, that rework takes the form of additional cost- and time-intensive rounds of prototyping and testing to address the errors. This cycle can lead to significant delays and elevate startups' costs to untenable levels. Such an approach can also stifle innovation, as engineers must devote so much development time to reaching minimum product viability that there is little bandwidth left to pursue fresh breakthroughs.

Many startups also rely on team members in far-flung locations. Interstellar Lab, for instance, has teams in Paris and Los Angeles who must be able to work together seamlessly. Without that ability, the risk of design errors puts project timelines and product quality at risk.

Beyond these internal difficulties, space industry startups must also often manage relationships with multiple suppliers and other partners because they do not possess their own manufacturing capabilities. Shepherding projects from design through production efficiently requires startups to work with these external stakeholders to source parts and materials, manufacture disparate systems, and assemble the products. If product data is not kept up to date and presented accurately to these stakeholders, errors can quickly proliferate, causing additional delays and jeopardizing project budgets.



TRADITIONAL TOOLS FAIL TO MEET THE MOMENT

The rapid expansion of the space industry has created plenty of exciting opportunities for new businesses to pursue. However, reliance on traditional product development solutions and processes puts these businesses at risk of being left behind by the competition.

Many companies still rely heavily on general-purpose office tools, such as email, documents, and spreadsheets, which are often used to manage product data and guide development. But these tools do not provide startups with the functionality they need to quickly and efficiently develop innovative new products. Instead, they increase the chances that stakeholders will lose track of design changes and other crucial product data. This makes coordinating engineering work and managing external partnerships difficult because stakeholders risk making decisions based on out-of-date or inaccurate information. In addition, these tools do not provide insight into system behaviors and performance early in design, so it's all but impossible to maximize the sustainability of both the product and the process used to manufacture it.

THE 3DEXPERIENCE PLATFORM HARNESSES THE POWER OF THE CLOUD

Imagine how fast and how far today's space industry startups could go, empowered by advanced product development solutions on a scalable platform available anytime, anywhere. Dassault Systèmes' **3D**EXPERIENCE platform on the cloud turns that vision into reality. By leveraging the power of Dassault Systèmes' **3D**EXPERIENCE SaaS solutions, they can access leading-edge capabilities and collaborate more efficiently in a secured environment. As a result, they will be able to:

- Get started right away, access to training, co-marketing opportunities and a tailored onboarding program
- Improve product quality at lower cost
- Increase innovation and get their products to market faster

This section details how the **3D**EXPERIENCE platform on the cloud serves the business needs of today's space industry startups.

COLLABORATIVE DESIGN ENABLES TOMORROW'S SPACE TECHNOLOGIES

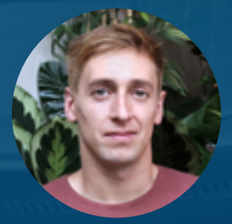
Companies of all sizes can utilize world-class design and engineering tools in the **3D**EXPERIENCE platform on the cloud. And as they grow, the solution grows with them, scaling to meet their evolving needs.

The platform breaks down the silos that so often make cross-disciplinary work tedious and complex. Users enjoy seamless, secure collaboration between all disciplines and engineering domains, wherever they are in the world. As these teams pursue innovation, the platform provides the single source of truth they need to ensure stakeholders make fully informed decisions based on always-accurate product data. Using the platform's robust social design environment, team members can coordinate their work early in the design process, iterate on and improve designs virtually, and reduce their reliance on costly, time-consuming rounds of physical prototyping and testing.

INNOVATION BEYOND EARTH AT INTERSTELLAR LAB

Interstellar Lab relies on the platform's robust functionality to ensure smooth collaboration between team members working on different continents and iterate on their groundbreaking BioPod designs.

"Not many platforms can provide that kind of functionality out of the box. 3DEXPERIENCE is a game changer for us as we're able to design and iterate at speed, bringing all our expertise and domains together in one place to come up with the best solutions. It allows us to move and innovate faster."



Jim Rhoné
Chief Product Officer at
Interstellar Lab

YURI LEVERAGES THE CLOUD TO TRANSFORM MICROGRAVITY EXPERIMENTS

The platform's design capabilities are also essential to YURI's success. The company has used **3D**EXPERIENCE to develop reusable modular hardware that allows them to keep costs low and move quickly from ideation to experiment launch in a matter of months—well ahead of their nearest competitor.

"The cloud platform is the best and most flexible solution for us, especially as it gives us the option to add more functionality as our requirements change and grow, without any disruption to our business [...] We can add new apps safe in the knowledge that we won't need to purchase additional hardware. Everything we need resides on one platform."

Mark Kugel,
Co-Founder and Chief Commercial Officer
at YURI

SIMULATION DELIVERS IMMERSIVE USER EXPERIENCE, REDUCES TIME TO MARKET, AND CUTS PROTOTYPING COSTS

How can space industry startups compete with the sector's enterprise companies when they so often lack the resources of their more well-established counterparts? The **3D**EXPERIENCE platform on the cloud makes it possible. The platform addresses space startups' most complex product engineering challenges by delivering simulation and high-performance computing capabilities that accelerate development while reducing risk and minimizing the likelihood of design failures.

The **3D**EXPERIENCE platform provides a range of powerful simulation functionality, including the following:

- **Structural simulation:** Users can assess products' structural performance under a wide range of conditions, which allows them to improve product performance and quality by making more fully informed design decisions.
- **Fluid flow and heat transfer simulation:** Users can accelerate product innovation by analyzing fluid flow and thermal performance to optimize materials selection and design. This helps companies improve product quality and eliminate manufacturing challenges.
- **Injection molded part design simulation:** Users can ensure the quality and manufacturability of injection molded part designs and tools by validating and optimizing those designs early in product development. This allows them to reduce reliance on physical prototyping and testing, which lowers costs and shortens time to market.

In the race to bring spacecraft and other products to market quickly, industry startups must be able to evaluate the behaviors, reliability, and safety of materials, components, and products before investing time and other resources into a physical prototype. The **3D**EXPERIENCE platform on the cloud delivers that capability, and companies like Interstellar Lab are reaping the benefits. They utilized the platform's simulation solutions to ensure their BioPods maintain proper air pressure, respond to environmental stress, and support plant growth.

Space industry products are particularly complex, making the ability to simulate structural, motion, thermal, fluid flow, and electromagnetic performance essential to driving innovation—and establishing shorter, more efficient development cycles without sacrificing product quality.

DELIVERING SUSTAINABLE SPACE MISSIONS

Driving innovation is, of course, not the only pressing concern facing today's space industry startups. These companies must also ensure the sustainability of their projects, which requires them to analyze how their materials, manufacturing, and launches affect the earth. But sustainability is an issue in space too.

The large and growing number of satellites in low-earth orbit increases traffic management challenges and light pollution and could even interfere with future scientific discoveries. Satellite re-entries pose a threat as well. They can deposit hazardous levels of alumina into the atmosphere during re-entry, potentially increasing solar radiation levels. To avoid these issues, startups must carefully plan for the end-of-life phase of satellites' lifecycles.

The **3D**EXPERIENCE platform helps space industry startups achieve their sustainability goals by supporting the following domains:

- **Clean space systems:** Space industry startups must design systems to be more sustainable across the product lifecycle.

The **3D**EXPERIENCE platform allows users to:

- create lighter designs that reduce waste;
- develop energy-efficient electric propulsion systems for satellites;
- design reusable rocketry to limit material usage; and
- organize manufacturing layouts to make production itself more sustainable.

- **In-orbit and in-space sustainable servicing:** Users can reduce the ever-growing amount of debris in Earth's orbit by designing systems to remove and recycle it. They can also extend product life spans to cut down on waste. In addition, they can develop methods for manufacturing in microgravity, which requires fewer materials and less fuel than manufacturing objects on Earth and then launching them into orbit. Such capabilities are essential to plans to build data centers and other facilities in space.

- **Geospatial analytics:** Users can optimize geospatial data processing and visualization to gain contextualized insights into GPS and weather satellite data. These insights illuminate the climate's effects on human movement patterns and more, which improves socio-economic development initiatives and helps stakeholders remain aligned with the UN's Sustainable Development Goals.

INTEGRATING INDUSTRY-LEADING TECHNOLOGIES

Products designed for space require complex engineering work from multiple disciplines. Engineers must integrate multiple tightly interconnected systems, all while ensuring the product is as lightweight as possible. The **3D**EXPERIENCE platform on the cloud provides them with the capabilities they need to navigate that complexity:

- **Model-based systems engineering (MBSE):** Users can capture, analyze, share, and manage important product information, which improves stakeholder communication and helps address the challenges of product complexity. When stakeholders can view and analyze precise, always-accurate system models, they can better understand the implications of design changes and use that understanding to improve product quality. The platform's MBSE capabilities can also reduce design cycle time and modification costs by improving mechanisms for capturing and reusing standardized product information.

- **Topology optimization and generative design:** Engineering teams can rely on the platform's bleeding-edge technologies to further improve product quality while maximizing design efficiency. Space industry startups can leverage its capabilities alongside artificial intelligence (AI) and machine learning (ML) to generate optimized, manufacturable designs that weigh less and use fewer resources while still satisfying key performance indicator (KPI) targets. This improves the product's performance and makes it more sustainable to manufacture and launch.

REIMAGINING MANUFACTURING AND OPERATIONS USING A VIRTUAL TWIN

To achieve new levels of efficiency and sustainability, space industry startups can leverage the power of the **3D**EXPERIENCE platform by creating a virtual twin of their product or system. This data-rich, interactive 3D model can be used to optimize manufacturing lines, simulate robotics, ergonomics, and assembly processes, and evaluate product or system performance under specific conditions.

For example, the **3D**EXPERIENCE platform can be used to define the layout of manufacturing facilities, allowing startups to simulate their operations and ensure an efficient and accurate build and installation.

This functionality is especially valuable for startups that are planning investments into new manufacturing facilities and want to increase supply chain efficiency by simplifying communication and collaboration with outside stakeholders.

In addition, the **3D**EXPERIENCE platform's virtual twin experience can provide a faithful representation of satellites, rockets, launchers, and more, allowing users to anticipate and better understand physical phenomena anywhere on Earth.

For instance, Dassault Systèmes partnered with Airbus Defense and Space to create the "Virtual Twin of Earth," combining satellite imaging, 3D modeling, and simulation of human activity to better understand and overcome future climate and environmental challenges.

“Using the power of simulation and applying real-world evidence to satellite images will enable users to anticipate and better understand physical phenomena anywhere on the Earth,” said Pierre Limondin, SIMULIA Sales Account Manager at Dassault Systèmes. ”The goal is to stimulate the development of sustainable innovations on an unprecedented scale.”

CONCLUSION

The space industry is rapidly changing with lower launch costs creating more startup opportunities. However, businesses face numerous challenges to stay competitive and cannot rely on outdated tools. Instead, they must use solutions made for this moment and the next: tools that empower design and engineering agility, enhance collaboration, improve design quality, and help them bring their innovations to market as quickly as possible.

Dassault Systèmes' **3D**EXPERIENCE platform delivers the advantages space industry startups need to push forward the frontier of space technology.

- It offers a flexible and competitive set of solutions covering the entire engineering value chain from concept to in-orbit operations.
- The platform's scalable, flexible delivery model on the cloud reduces IT infrastructure expenses.
- Dassault Systèmes' decades of experience and range of essential services provides startups the full-scale support they need to see value from day one.

If you are interested in learning more about how the **3D**EXPERIENCE platform on the cloud can benefit your space industry startup, please visit our **3D**EXPERIENCE for startups page and explore our space solutions here.

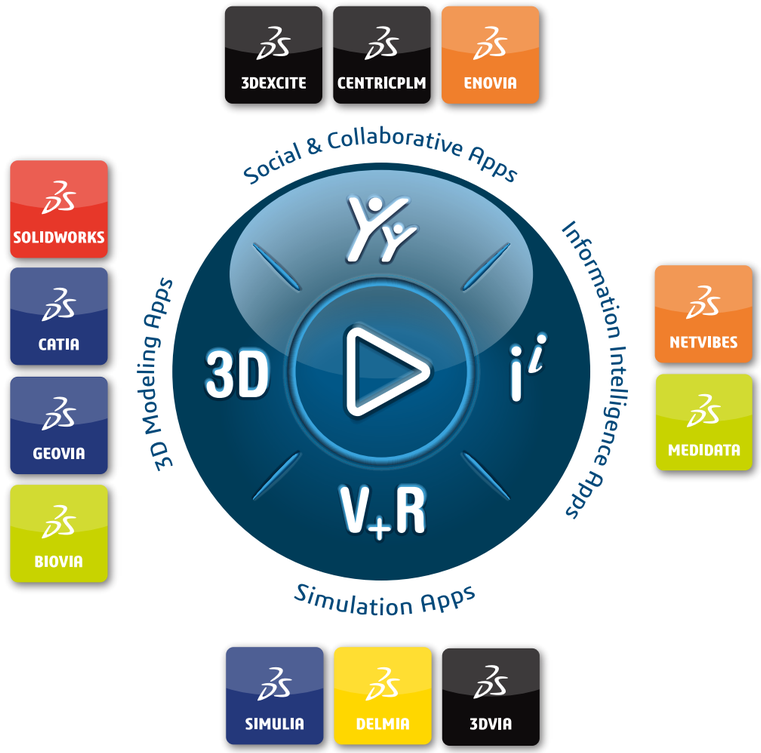
Our team is here to support you on your journey. Don't hesitate to contact us to discover how we can help your business thrive.

Contact our experts now

Our **3D**EXPERIENCE® platform powers our brand applications, serving 12 industries, and provides a rich portfolio of industry solution experiences.

Dassault Systèmes, the **3DEXPERIENCE** Company, is a catalyst for human progress. We provide business and people with collaborative virtual environments to imagine sustainable innovations. By creating virtual twin experiences of the real world with our **3DEXPERIENCE** platform and applications, our customers can redefine the creation, production and life-cycle-management processes of their offer and thus have a meaningful impact to make the world more sustainable. The beauty of the Experience Economy is that it is a human-centered economy for the benefit of all –consumers, patients and citizens.

Dassault Systèmes brings value to more than 300,000 customers of all sizes, in all industries, in more than 150 countries. For more information, visit **www.3ds.com**.



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