

Airbus Accelerates Space Exploration to Mars

An iBASEt MES Customer Success Story



Image 1: Airbus has designed and built the ESA ExoMars rover vehicle, Europe's first rover to another planet.

🖂 inquiry@ibaset.com

🚱 www.ibaset.com

949.598.2600

949.598.5200

27442 Portola Pkwy Suite 300 Foothill Ranch, CA 92610, USA

INTRODUCTION

Here's something you may not have thought about with space exploration. When we travel to other planets, it's important to not take any of Earth's contamination with us. This means that the manufacturing of Airbus Defence and Space division's new ExoMars Rover must be conducted in a biological clean room where a single sheet of paper could contain contaminants. For this and other reasons, a digital production system was required.

Airbus is a European multinational aerospace corporation headquartered in Leiden, Netherlands. Their Defence and Space division makes specialized, one-off products for complex space exploration missions. Airbus has been involved in missions to Mars since the first European mission in 2003. This division won a bid to produce the ExoMars Rover 2022.¹ The mission is targeting a September 2022 launch window, landing on Mars in June 2023. The goal is to determine the geological history of the landing site at Oxia Planum, once thought to host an ancient ocean, and to determine if life could ever have existed on Mars.²

This new contract triggered a decision to pick a new Manufacturing Execution System (MES) that was the right fit for the project. After a thoughtful evaluation, Airbus chose iBASEt's MES, powered by Solumina, which has been used by other divisions at Airbus since 2011.



Image 2: The ExoMars Rosalind Franklin Rover is seen here sitting on top of the Kazachok surface science platform in a stowed configuration, like how it will journey to Mars in 2022. © Thales Alenia Space.



¹ Mars Express: The first mission to the Red planet, <u>t.ly/jRM5</u>

² ExoMars Rover joins Kazachok platform, December 8, 2020; t.ly/zbU6

MEETING THE CHALLENGES

Building a Mars Rover is, as one might imagine, a highly complex manufacturing endeavour. The Airbus Defence and Space division develops state-of-the-art technology using unique materials to manufacture heat shields, honeycomb panels, and all the other parts necessary to assemble the ExoMars Rover.

According to Leon Rowson, Airbus AIT Mechanical Satellite Manager, "Every mission requires brand new designs and material requirements, such as antennas and reflectors that are packed into a sleeping bagsized container and then deployed to several meters."

With the rapid advance of space technology, production processes frequently change based on new engineering designs, project requirements, and new information that is learned during the product life cycle. All the delicate, cutting-edge technology requires an extreme level of quality assurance. There is only one chance for the mission to go right. If anything goes wrong, down to the smallest detail, then the entire mission is at risk of failure.

If that wasn't difficult enough, there is another challenge to building the ExoMars Rover. Planetary protection rules, ratified by the United Nations and endorsed by NASA, urge scientists to take every possible measure to prevent Earth's biological contamination from reaching moons or planets.



Image 3: ERO will reach Mars orbit, capture orbiting samples, and bring them back to Earth (artist's rendering). © Airbus.



THE SOLUTION

After winning the contract for the ExoMars Rover mission, Airbus created a state-of-the-art biological cleanroom to manufacture the vehicle. Since any object that entered the cleanroom could be a contamination threat, it was critical to reduce the number of people, pencils, and paper that would have to enter the room.

Remote working took on a whole new perspective when operating in such a high-precision, complex manufacturing environment. Ideally, the production team preferred to work outside the room to avoid any unnecessary contaminants. It could take up to 45 minutes to don all the protective gear needed before entering the cleanroom, which includes scrubs as the bottom layer, 2 pairs of sterilized gloves, a gown, shoe covers, and much more.

"We used special tablets to run our MES system, schedule efficiently, and produce all kinds of standard documents and reporting," stated Christopher Morris, Industrial Systems Engineer, Airbus Defence and Space. "In a completely digital environment without pencils and paper, technicians were able to reduce overall build time, maintain strict quality standards, and keep the clean room free of contaminants."

This turned into a huge advantage in this special application. With what Airbus internally refers to as their Solumina Integrated Production System (IPS), their team could perform many operations remotely, outside of the cleanroom. Airbus was able to significantly reduce the number of people needed in the cleanroom, as well as the number of potentially contaminated objects. This eliminated many of the headaches of a cleanroom production process and allowed the entire team to work more productively.

As explained by Rowson, "Quality is key. Solumina lets us tightly control the process, validate everything, configure systems properly, and sign off quickly. When we're executing the process remotely, people can see who has done what and can follow the process closely. As we moved to digital, we adapted and reviewed processes—not just move from paper to digital. iBASEt helped us to do that." "We reaped the benefits of efficiency. Our Solumina IPS really helped to transform how we worked as a team, sticking to one plan that could be modified easily."

Christopher Morris, Industrial Systems Engineer, Airbus Defence and Space

"We gained crossfunctional visibility with tightly integrated production, quality assurance, and work orders that helped to improve efficiency."

Leon Rowson, AIT Mechanical Satellite Manager, Airbus Defence and Space

KEY BENEFITS

- Improved time productivity and work efficiency
- Reduced cleanroom interaction helped save time while reducing onsite worker dependency
- Seamless integration with Product Lifecycle Management (PTC Windchill), Enterprise Resource Planning (SAP), and Advanced Planning & Scheduling (Primavera P6) systems helped to better manage the flow of data supporting frequent engineering design changes
- Clearer visibility of the production process
- Heightened quality assurance during the build
- Reduced need for on-site workers, allowing more jobs to be performed remotely
- Standardized work plans
- Faster signature loops which enable remote signatures and single sign-off documents for multiple unit integrations
- Easier to share information quickly and efficiently with hundreds of users across all worksites worldwide



Image 4: Airbus Defence and Space Bio Cleanroom, Stevenage. © Max Alexander / Airbus.

CONCLUSION

The ExoMars Rover is scheduled for launch in the Fall of 2022 from the Baikonur launch complex in Kazakhstan. Approximately nine months later, it will reach the surface of Mars. As we move forward in the future of space exploration, digitalized production processes capable of managing complex, dynamic engineering designs will help drive its success. To successfully perform missions of this magnitude, manufacturers will be challenged to innovate and find new ways to streamline and improve their processes, while keeping strict quality assurance.

Airbus and the ExoMars Rover is an excellent example of the "art of the possible." Any manufacturer considering how to design, manage, and deliver innovative, highly complex products can learn from what Airbus has accomplished. Their move to paperless operations played an important role in the success that has already been achieved. In today's strict, highly regulated, and complex manufacturing environments, the right MES can be your most trusted asset.

About ExoMars

ExoMars is a European Space Agency programme executed in cooperation with the Russian Space Agency Roscosmos with the contribution of NASA. Thales Alenia Space is the ExoMars mission prime, and the main other industrial partners are OHB for the carrier and Lavochkin for the descent module. The rover integration was completed at Airbus in the UK with Thales Alenia Space supplying the Analytical Laboratory Drawer, OHB the complex laboratory mechanisms, Leonardo providing the drill and nine different instrument teams from ESA Member States, NASA/GSFC and IKI/Roscosmos providing its Pasteur payload set.



Image 5: Thermal-vacuum testing for ExoMars at Airbus in Toulouse. $\ensuremath{\mathbb{C}}$ Airbus.



ABOUT IBASET

Headquartered in Foothill Ranch, California, iBASEt simplifies complex manufacturing. Its solutions replace disparate production, quality, and MRO applications with paperless, digitally integrated solutions. The iBASEt Digital Operations Suite synchronizes data and processes to foster collaboration by establishing and maintaining a digital thread that spans enterprise systems to internal and external teams. From process and inspection, planning to the shop floor, and the execution of sustainment activities, iBASEt's proven, pre-configured, and out-of-the-box solutions deliver real-time visibility and control that accelerates manufacturing performance.

The iBASEt Digital Operations Suite comprises a portfolio of Model-based Manufacturing applications that includes iBASEt's Manufacturing Execution System (MES), Supplier Quality Management (SQM), and Maintenance, Repair, and Overhaul (MRO) solutions. This digital suite connects the shop floor to the top floor to ensure high quality, consistent practices, continuous product and process improvement, and embedded compliance with process standards including ISO 9001, ISO 13485, AS9100, and FDA's 21 CFR Part 11 and Part 820.

With 30+ years of experience in highly engineered, regulated industries, iBASEt simplifies the complex by empowering customers to gain real-time visibility, take control, and drive velocity across their operations.

The iSeries, powered by the Solumina platform, has a cloud-native microservices architecture with open APIs that extends a digital ecosystem to drive innovation, simplify hardware and software systems integration, and deploy advanced technologies. iBASEt works closely with many industry leaders, including Lockheed Martin, Northrop Grumman, Rolls Royce, Pratt & Whitney, and Textron. Learn more at ibaset.com.



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