DASSAULT SYSTEMES

SAFE PUBLIC ENVIRONMENT
SIMULATION SOLUTIONS TO MITIGATE RISKS OF AIRBORNE CONTAMINATION

THE CHALLENGE

Water droplets is one of the primary transmission vectors of the SARS-CoV-2 coronavirus that leads to COVID-19. Increasingly, scientific communities claim that the virus can spread through airborne particles. While coughing or sneezing projects large numbers of respiratory droplets, talking and breathing also releases them. These droplets are potentially transported through the air, carried by the surrounding airflow, and can be inhalated by others. They can also deposit on surfaces that other people touch, leading to further infection. Besides, individuals can be contagious for several days before symptoms manifest, and people with mild or asymptomatic cases may not realize they are infected at all.

In those conditions

- Hospitals have to ensure that vulnerable patients and staff are not put at risk;
- Universities, administrative buildings and office spaces have to re-open safely;
- Cultural and touristic venues, undergoing a critical economic slump, have now to take into account this new risk to welcome back the public (concert and exhibition halls, museums, hotels, shopping malls, indoor stadiums…);
- Transportation sector also goes through an economic slowdown. Restarting the economy will require ramping up domestic and international transport infrastructure (air & train), while securing the confidence of the passengers.

Managing a pandemic, especially as economic activity and daily life resumes, requires specific measures and changes to everyday environments to control the transmission of the disease.

HOW WE CAN HELP

Leveraging simulation enables the analysis of contamination risks and helps to design palliative measures. The visualization of the propagation of potentially contaminated droplets or aerosols through environments offers intelligible information to act on and also provides clear, easy-to-understand images or videos to use to educate and reassure customers.

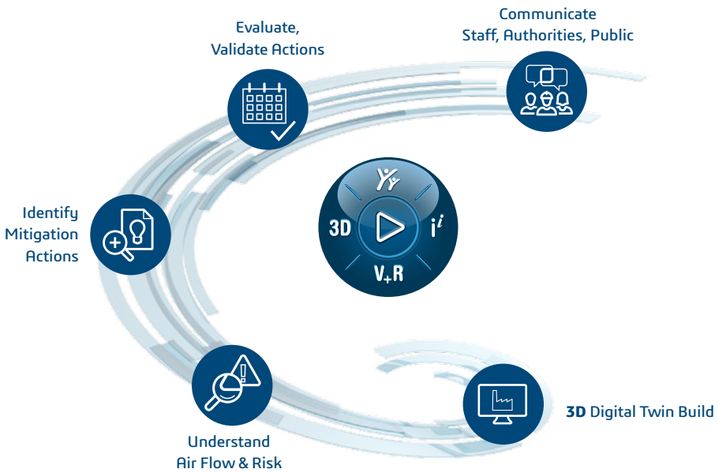
Dassault Systèmes SIMULIA fluid numerical simulation solutions, powered by key technologies PowerFLOW and XFlow, can accurately model turbulent airflow, particle motion and tracking, as well as surface deposition in complex environments.

Creating safer healthcare facilities

Hospitals were the first to use Dassault Systèmes simulation tools to better understand the particles propagation, to ensure ventilation systems can effectively remove the virus and to reorganize rooms/buildings layout to avoid putting vulnerable patients and staff at risk.

- Medical facilities contain indeed both COVID-19 patients and people who are considered high risk such as the elderly, immunocompromised and those undergoing treatment for other conditions, as well as medical and support staff. Although these groups are kept apart as much as possible and personal protection equipment (PPE) is now made largely available, potential transmission routes, such as ventilation systems and drafts through doors and windows, can lead to rapid outbreaks if not identified and sealed.
- Thanks to simulation tools, existing hospitals can rapidly be adapted to meet the needs of a health crisis, and new hospitals can be designed in a safer way to integrate pandemic risks. Dassault Systèmes has already been working with Saint-François hospital in Marange-Silvange (East of France), Montsouris and Bichat hospitals in Paris, Leishenshan hospital in China (built in just 2 weeks in Wuhan), and a new medical nursing home to be built in Cannes (South of France).

OUR SOLUTION

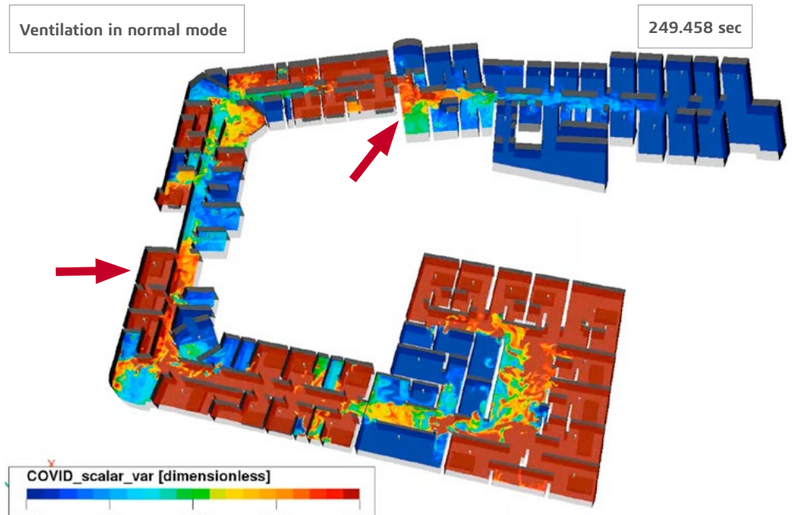


CASE 1
SAINT-FRANÇOIS HOSPITAL

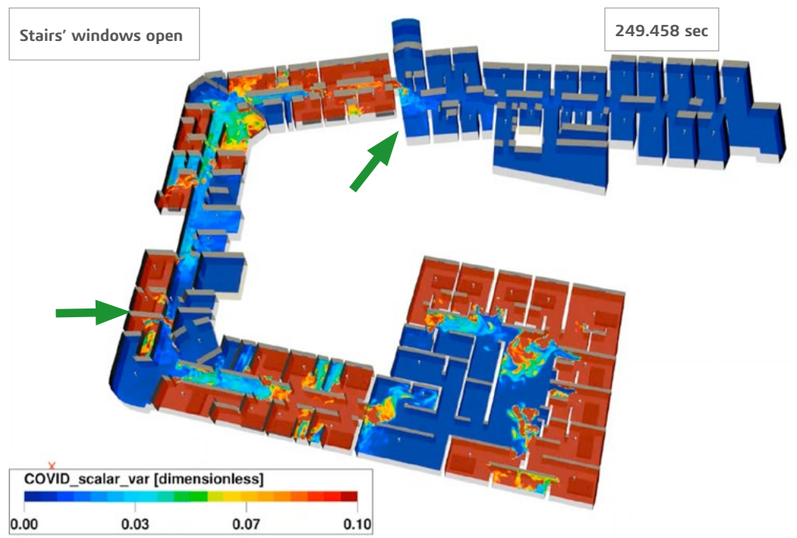
East of France was the first region hardly impacted by the COVID-19 pandemic. Both patients and medical staff were very quickly contaminated in March 2020.

The director of Marange-Silvange hospital was facing the challenge of having to welcome many infected patients in an area right next to where he was already welcoming elderly people, considerated as a population highly at risk. In the middle of the crisis in April 2020, he contacted Dassault Systèmes to understand how contaminated air was travelling within rooms and corridors of his hospital and to find quick and simple solutions to mitigate risks. Thanks to Dassault Systèmes fluid solutions and experts, he was able to investigate how different ventilation settings impacted particles propagation.

> "We detected viral contamination among all samples, indicating that SARS-CoV-2 may spread through both direct (droplet and person-to-person) as well as indirect mechanisms (contaminated objects and airborne transmission). Taken together, these findings support the use of airborne isolation precautions when caring for COVID-19 patients."
>
> Aerosol and Surface Transmission Potential of SARS-CoV-2
> published on June 3, 2020
> by University of Nebraska Medical Center



Contaminated air was travelling from the COVID-19 area (red zone) to the elderly area (blue zone) through the corridors because of the ventilation system.



A simple solution such as opening the windows in strategic positions was successfully evaluated by the simulation. The director quickly mitigated the risk by following the simulation conclusions and used the videos to brief his staff.

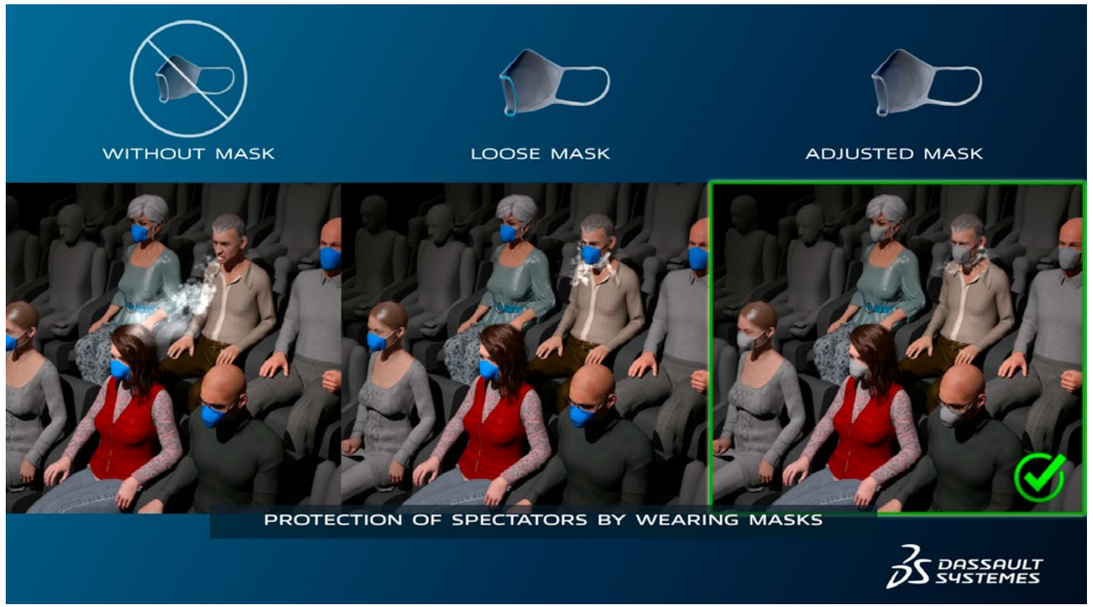
CASE 2
PHILARMONIC CONCERT HALL

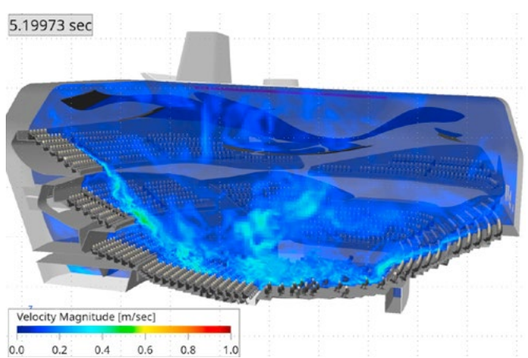
As an outcome to the sanitary crisis, the cultural sector is facing a strong economic crisis after several months of shutdown. In this context, the director of the Philharmonic concert hall of Paris was facing the challenge of re-opening rapidly while having to reassure & protect its public, staff and orchestra. Therefore, in July 2020, he decided to use Dassault Systèmes simulation tools to analyze how to re-open in best conditions.

Thanks to Dassault Systèmes simulation solutions and experts, the management of La Philarmonie was able to understand:

- How ventilation systems can mitigate the risk
- How seating positions of the public & orchestra, wearing or not wearing a mask, can influence the propagation of a potential contamination
- They were able to use simulation videos to reassure the public, staff and future orchestra performing.

> "Safety is not negotiable.
> This is why we decided to partner with Dassault Systèmes.
> Thanks to their cutting-edge simulation technology, we were able to re-open our concert hall in the best possible conditions"
>
> Laurent Bayle,
> Chairman, La Philharmonie de Paris

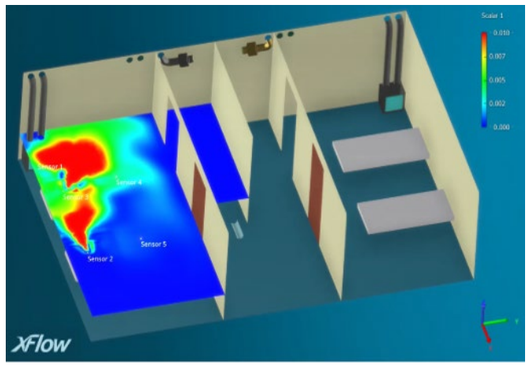


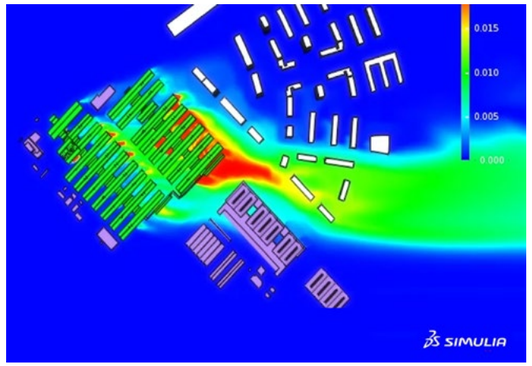


CASE 3
LEISHENSHAN MODULAR HOSPITAL

Being at the core of the pandemic, China had to react quickly to prevent the spread of the virus. In the midst of the crisis in March 2020, this largest hospital for infectious diseases and COVID-19 patients was created at Wuhan with "China Speed" surprising the world with its 14-day construction. China's Central-South Architectural Design Institute (CSADI) used Dassault Systèmes simulation capabilities at the conception stage of the hospital to simulate virus contamination and diffusion within the hospital's ventilation system and to counteract the negative effects from unplanned ventilation risks.

- Simulating indoor air distribution schema
- Optimizing suggestions on better contamination discharge in negative pressure wards to protect medical personnel
- Simulating outdoor exhaust emission impacts on nearby surroundings to help the design and site selection of the modular hospital





Creating safer life environments

Simulation solutions can also prove essential in other kinds of public and private spaces welcoming visitors such as:

- Concert and exhibition halls, museums and indoor stadiums
- Universities
- Administrative buildings and office spaces
- Airports and aircraft cabins
- Rail and metro stations/carriages
- Hotels, shopping malls…

Simulation information can be used to reinforce the case in favor of wearing a mask, to adapt the layout of a living space to ensure sufficient distancing, or to optimize ventilation and filtration systems to reduce the risk of airborn propagation of the virus. Ventilation modifications, physical barriers, masks and rearranging spaces to allow social distancing can all reduce the risk of transmission.

CONCLUSION

Understanding airflow schemes within an existing or to-be-built facility is a fundamental pre-requisite to minimize risks of contamination.

Cloud computing enables fast simulation of complex environments without the need for on-site hardware, minimizing the disruption of home-working and allowing rapid scaling-up for new ideas. The Dassault Systèmes **3D**EXPERIENCE platform allows users to collaborate without being physically present, and to quickly assemble design data into simulation-ready projects. Images and videos produced are key to explain propagation to the public and reassure customers, passengers, staff and investors.

DASSAULT SYSTÈMES COMPANY PURPOSE

"Dassault Systèmes provides business and people with **3D**EXPERIENCE universes to imagine **sustainable** innovations capable of harmonizing product, nature and life."

– Bernard Charlès, CEO Dassault Systèmes

WHY DASSAULT SYSTÈMES

VALUE OF PARTNERING WITH DASSAULT SYSTÈMES

Dassault Systèmes offers a strategic partnership with unparalleled experience in transforming organizations in highly complex environments to assist with innovation transformation.

Now more than ever, public organizations and stakeholders need a trusted, strategic partner that understands their vision and shares their passion for what is possible in today's rapidly changing global and technology-driven environment.

Dassault Systèmes, the **3D**EXPERIENCE Company, is a catalyst for human progress. We provide business and people with collaborative virtual environments to imagine sustainable innovations. By creating 'virtual experience twins' of the real world with our **3D**EXPERIENCE platform and applications, our customers push the boundaries of innovation, learning and production.

Dassault Systèmes' 20,000 employees are bringing value to more than 270,000 customers of all sizes, in all industries, in more than 140 countries. For more information, visit **www.3ds.com**.

NEXT STEPS

Our team is prepared to jointly engage with you to identify high value opportunities, develop a benefit case and build an implementation roadmap aligned with your priorities. We propose initial reviews with key stakeholders to explain the opportunities Dassault Systèmes can bring to their organizations. At the conclusion of our findings, we propose an executive workshop to define the approach, scope, and timelines necessary to codify the opportunity potential and develop a roadmap for implementation.

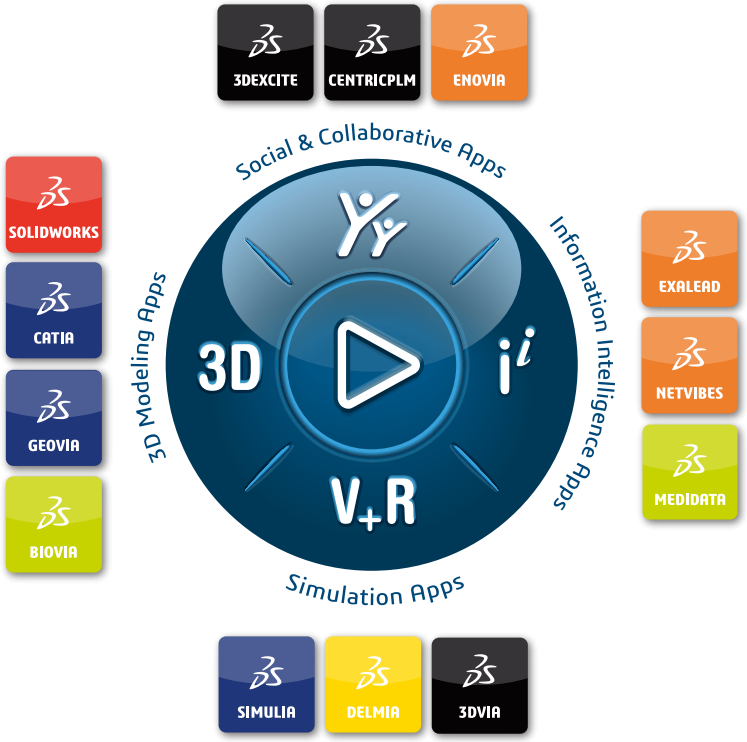
Recommended next steps for the transformation journey:

- Share and review Dassault Systèmes' Value Perspective with leaders and key stakeholders across the organization
- Plan a Value Assessment to build a mutual understanding of your specific strategy and challenges. Confirm and clarify any specific objectives and initiatives as well as any barrier towards this achievement
- Develop an agreed high-level implementation roadmap aligned directly to high value opportunities, with established KPIs to measure success and a robust business case to justify any required investment

Achieving this bold vision for transforming the approach to game-changing public environment management will require significant focus and leadership commitment along with a strategic business partnership with a company like Dassault Systèmes that is committed to enabling a successful outcome.

Dassault Systèmes brings unparalleled experience and a strong track record that will help you drive innovation, quality and excellence to deliver sustainable solutions and allow "safe public environment" measures' deployment .

Dassault Systèmes® is committed to enabling a successful transformation program with you.



Our **3D**EXPERIENCE® platform powers our brand applications, serving 11 industries, and provides a rich portfolio of industry solution experiences.

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