Virtual Twins for Industry Digitalization and Smart Cities

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/ Innovations Expert, Manuvalley.tech
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Bentley Qualified Trainer
ContextCapture

MANUFACTURING INNOVATION VALLEY

IN RE

IN RE is over 25 Years in Computer-Aided Engineering Market in Lithuania

- Implementation of construction engineering systems
  - Licensing, implementing, integrating and supporting digitalization process in plant, civil and building engineering
- Building Information Modelling (BIM)
  - Providing services for management and coordination of BIM projects, consulting on implementation of BIM technologies
- Modelling of Technological Processes
  - Modelling of technological processes for newly designed facilities and for plant and power facilities in operation
- Automated photogrammetry and VR
  - Performing the reality modelling projects using automated photogrammetry and virtual reality (VR) technologies.

Manufacturing Innovation Valley (Manuvalley) is the 1st innovation space for manufacturing enterprises in the Baltic States

- One of Digital Innovation Hubs (DIHs), supported by Lithuanian Government and European Union.
- The mission is to create the environment of ultimate convenience for developers of technologies and manufacturers of products from Lithuania and abroad.
- The ambition is to bring the latest industrial innovation trends to the Baltic States.
- The physical infrastructure, where manufacturing innovation laboratories operate according to EU strategy “Manufuture 2030”

IN RE is the Operator of the **Virtual Twin Lab** at Manuvalley with the registered trademark

3DEXPERIENCE® Works EXCELLENCE CENTER


3DEXPERIENCE®
EXCELLENCE CENTER
Works

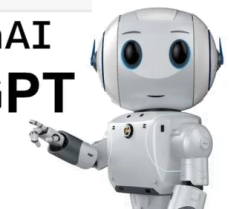

3DEXPERIENCE® Works
Projektavimo
platforma
SW
3D
V.R
Bendradarbiavimo
ir valdymo platform
Partneriai
Užsakovai


ERIENCE®
Works
CE CENTER

The term "Digital Twin" and its formal definition began to gain prominence in the early 2000s. While the concept of creating digital representations of physical objects or systems dates back earlier, it was around this time that it started to be widely discussed and defined within the context of modern technology and industrial applications.

One of the early mentions of the term "Digital Twin" can be attributed to Dr. Michael Grieves, a professor at the Florida Institute of Technology, who coined the term in a research paper published in 2002. He defined Digital Twins as "the digital representation of a product or process, which is used to understand and predict the physical counterpart's performance characteristics."

Since then, the concept of Digital Twins has evolved and expanded, finding applications in various industries beyond manufacturing, such as healthcare, transportation, and urban planning, among others. It has become a foundational concept in the development of Industry 4.0 and the Internet of Things (IoT).

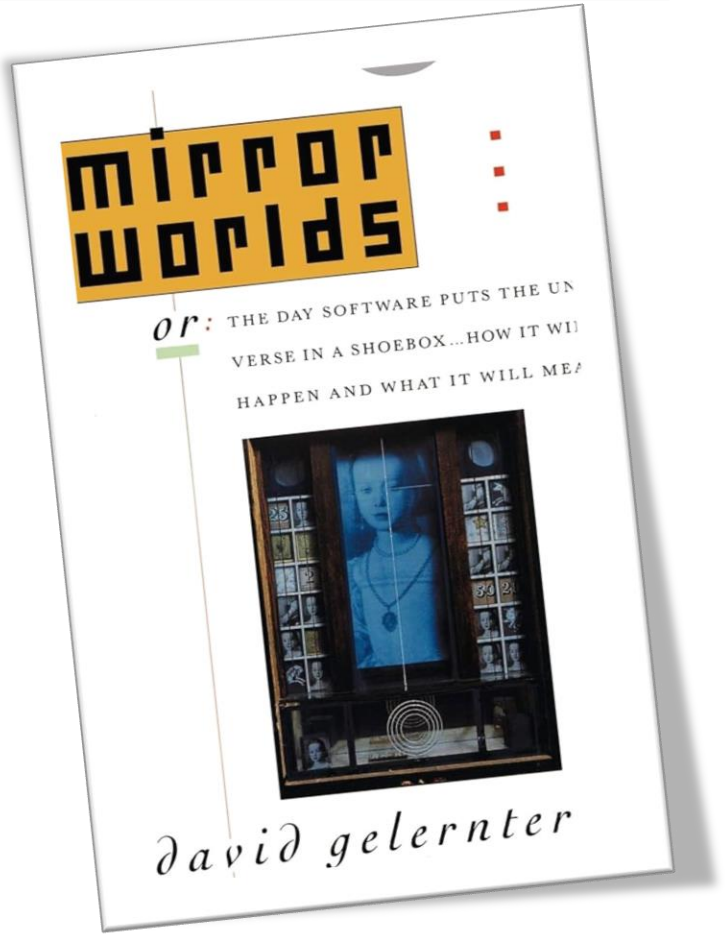


The definition of Digital Twin

- First time suggested by David Gelernter, a professor of computer science at Yale University, in **1991** in his book ***Mirror Worlds:*** *or the Day Software Puts the Universe in a Shoebox... How It Will Happen and What It Will Mean*, discussing the **virtual representations of the real world** created using computer software

- In **2002**, Dr. Michael Grieves, University of Michigan, formally announced the **digital twin software concept to manufacturing** at a Society of Manufacturing Engineers conference in Troy, Michigan

- The idea of a "digital twin" was born at NASA in the 1960s as a "living model" of the Apollo mission, when each voyaging spacecraft was exactly replicated in an earthbound version that was used for study and simulation purposes (https://ntrs.nasa.gov/citations/20210023699)



Digital Twin vs. Virtual Twin

Digital Twin –

‘virtual representation of a real-world entity or system’

Gartner

Virtual twin experiences let you **visualize, model and simulate the entire environment of sophisticated experience**.

They facilitate sustainable business innovation **across the full product lifecycle**

DASSAULT SYSTEMES

From 3D Design to Virtual Twin Experience

1981
3D Design

1989
3D DMU
Digital Mock-up

1999
3D PLM
Product Lifecycle Management

2012
3DEXPERIENCE® platform

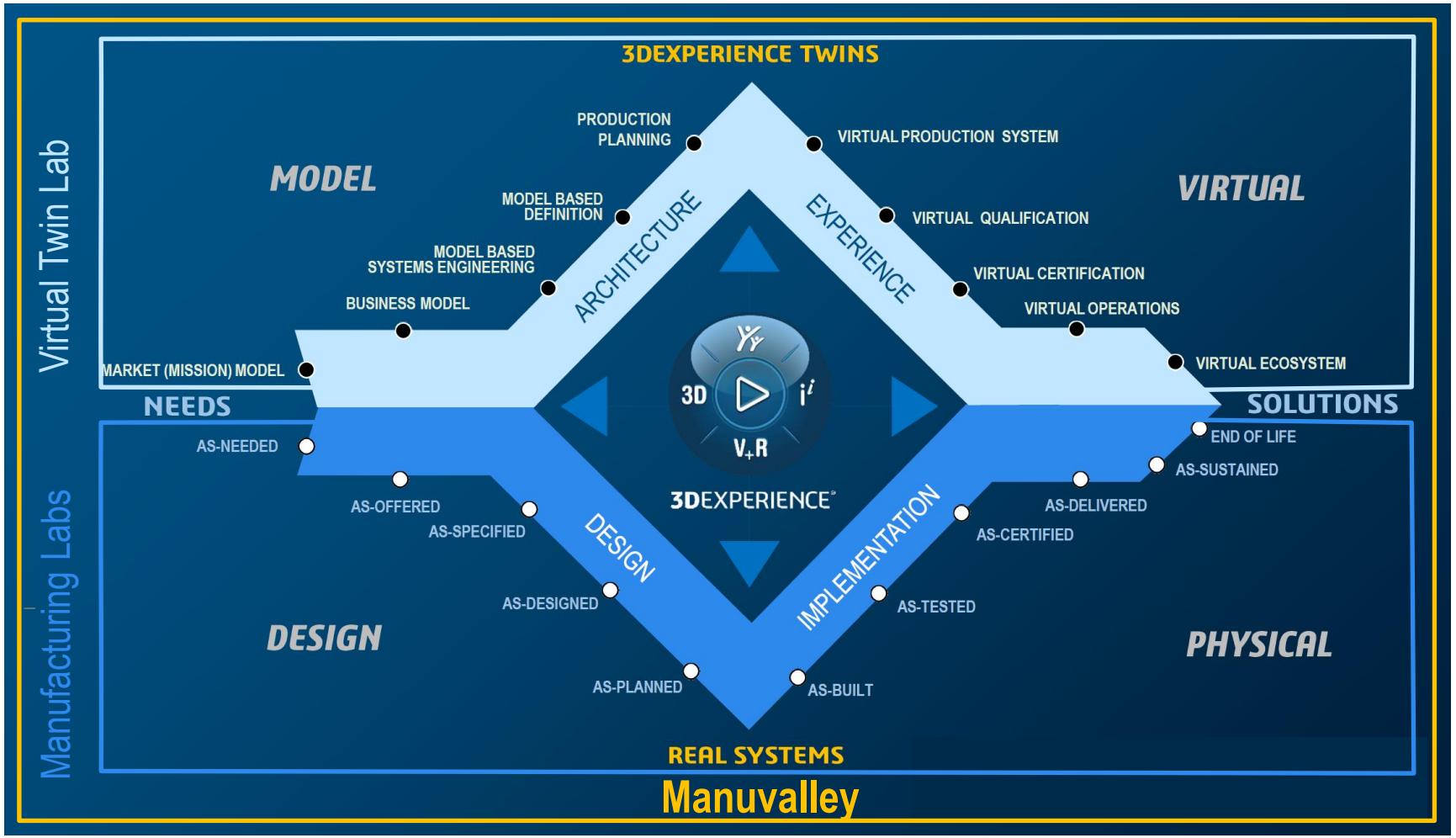
2020
Virtual Twin Experience of **Humans**

DASSAULT SYSTEMES | The 3DEXPERIENCE® Company

Virtual Twin Lab brings the Virtual Dimension over the Physical Dimension of Manuvalley LT

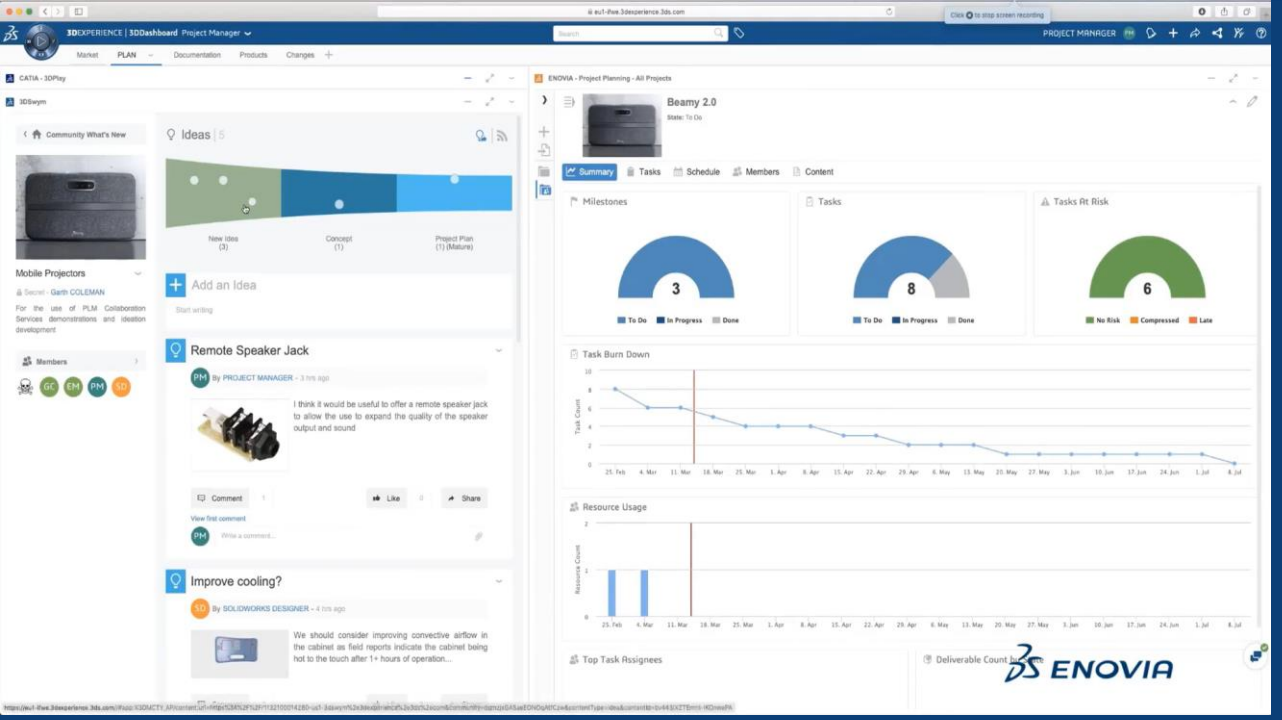
3DEXPERIENCE® Works
EXCELLENCE CENTER

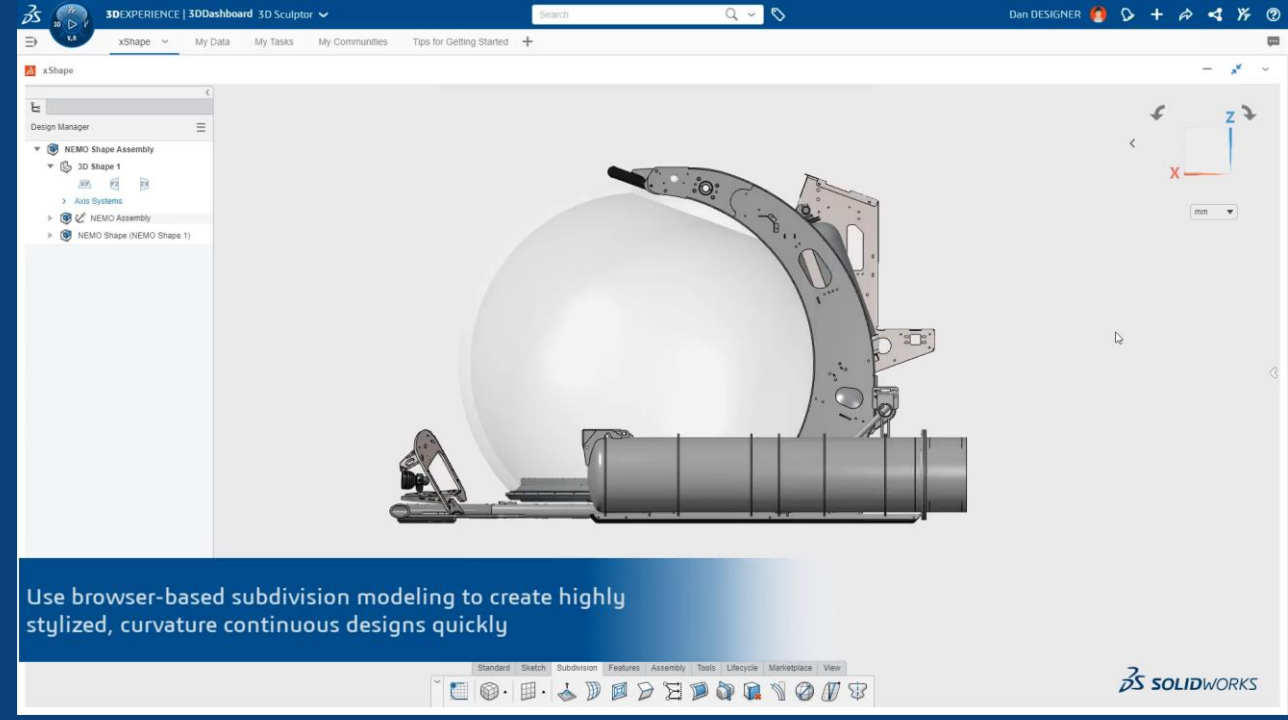
MANUFACTURING INNOVATION VALLEY

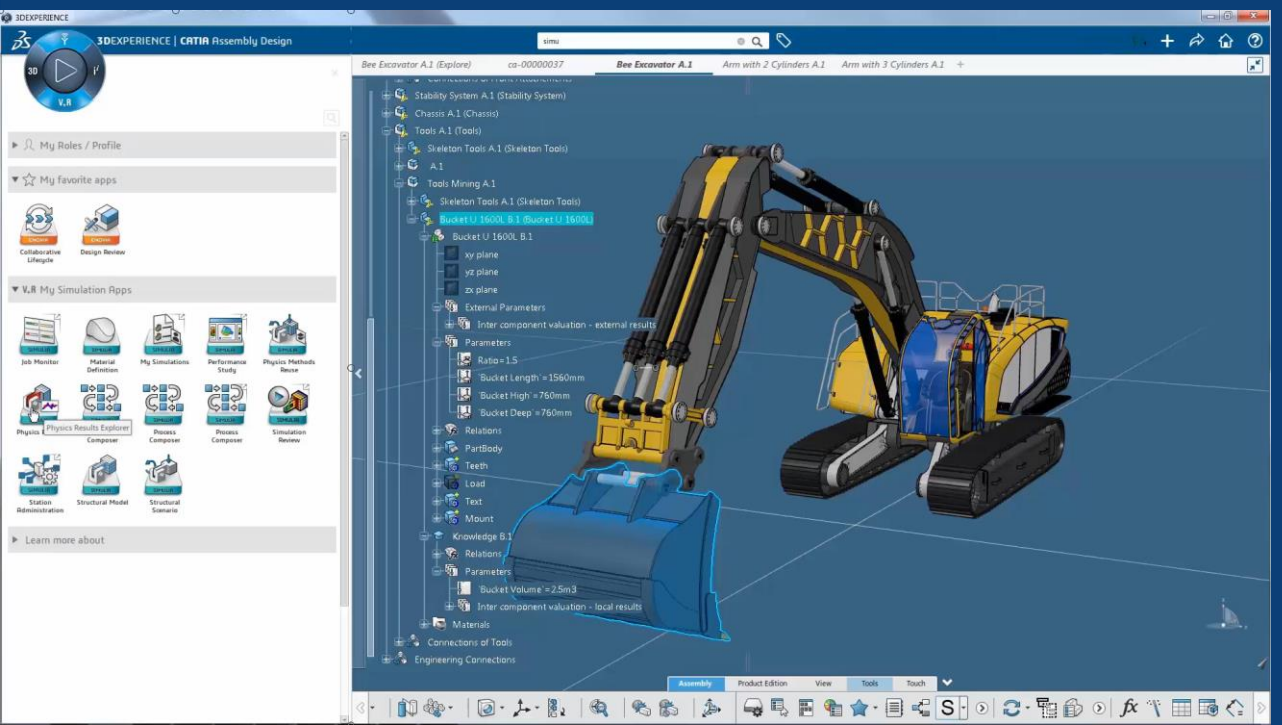


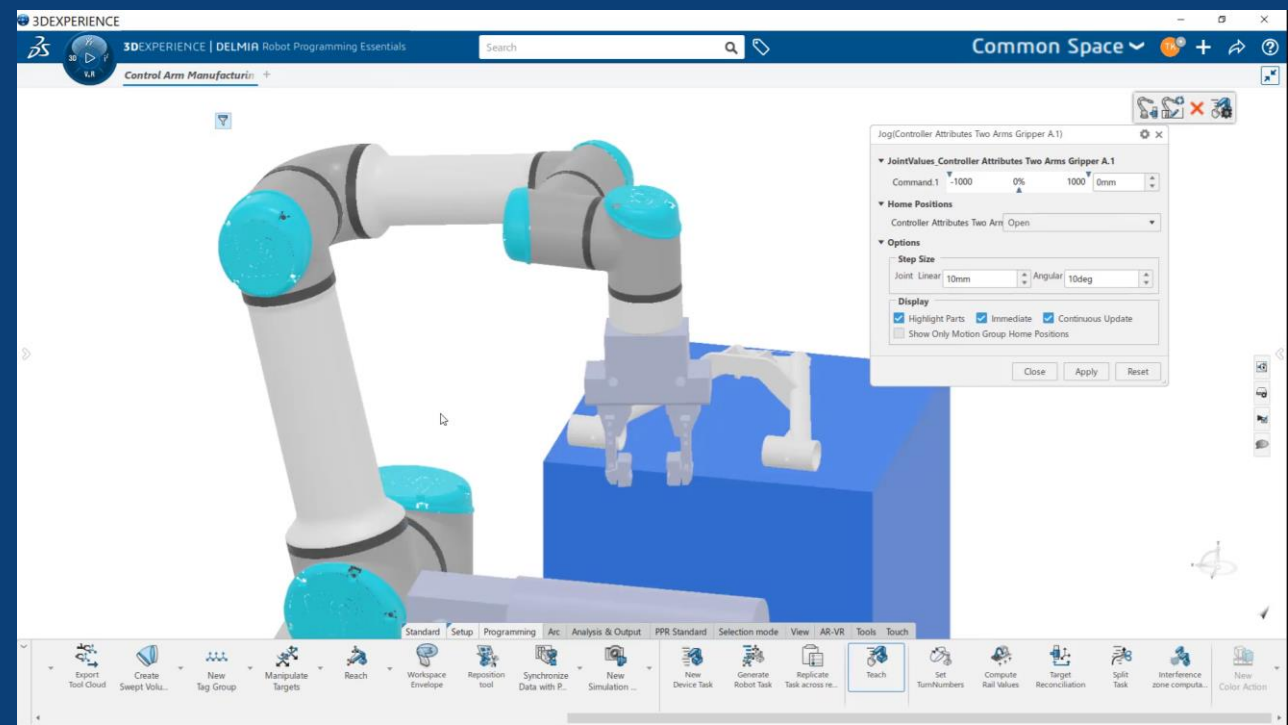
SOLIDWORKS
IN RE Computer-Aided Engineering Services

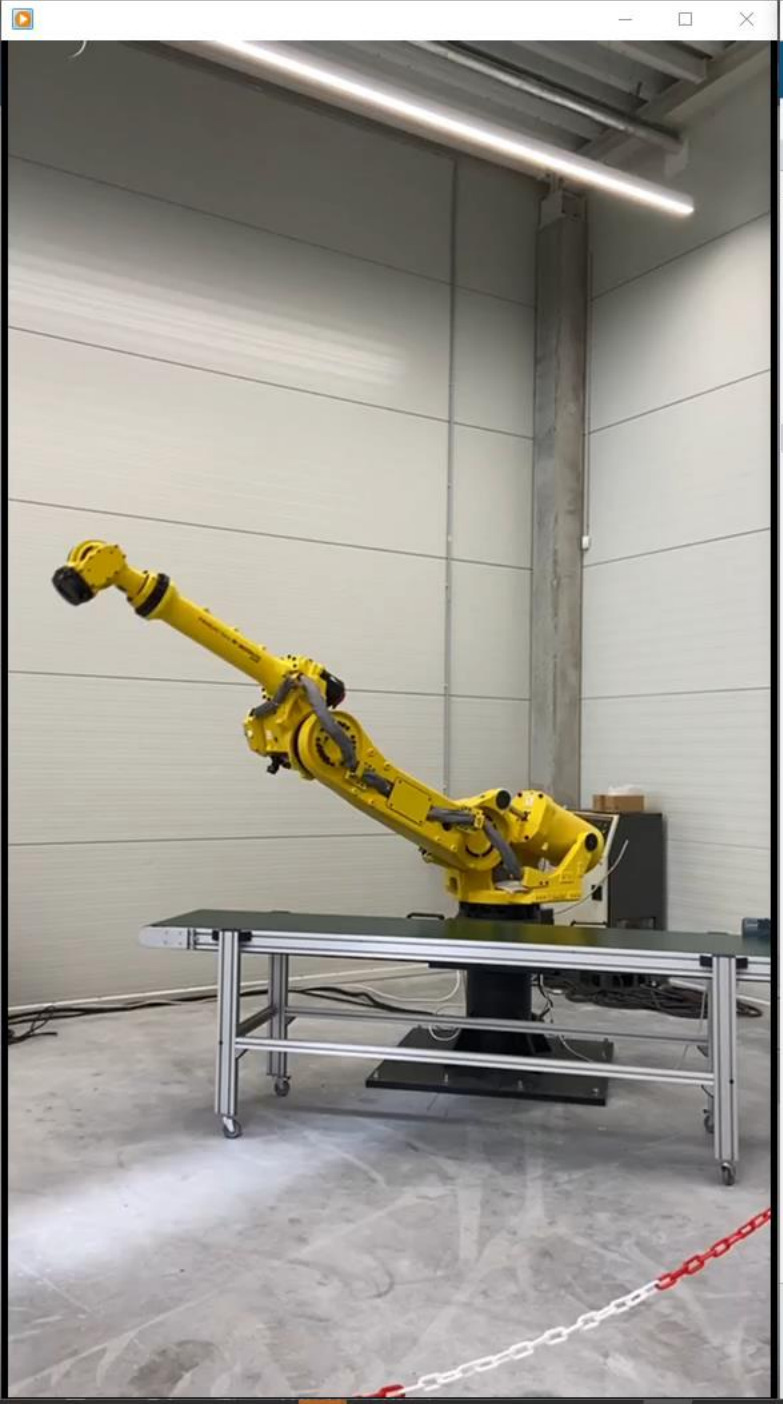
DASSAULT SYSTEMES | The 3DEXPERIENCE® Company


3DEXPERIENCE | 3DDashboard Project Manager
Ideas
Add an Idea
Remote Speaker Jack
Improve cooling?
Beamy 2.0
Milestones
Tasks
Tasks At Risk
Task Burn Down
Resource Usage
Top Task Assignees
ENOVIA


3DEXPERIENCE | 3DDashboard 3D Sculptor
xShape
Design Manager
NEMO Shape Assembly
3D Shape 1
Use browser-based subdivision modeling to create highly stylized, curvature continuous designs quickly
SOLIDWORKS


3DEXPERIENCE | CATIA Assembly Design
My Roles / Profile
My favorite apps
V,R My Simulation Apps
Learn more about
Bee Excavator A.1
Stability System A.1 (Stability System)
Chassis A.1 (Chassis)
Tools A.1 (Tools)
Tools Mining A.1
Bucket U 1600L B.1
External Parameters
Parameters
Relations
PartBody
Teeth
Load
Text
Mount
Knowledge B.1
Materials
Connections of Tools
Engineering Connections


3DEXPERIENCE | DELMIA Robot Programming Essentials
Common Space
Control Arm Manufacturin
Jog(Controller Attributes Two Arms Gripper A.1)
JointValues_Controller Attributes Two Arms Gripper A.1
Home Positions
Options
Step Size
Display
Close
Apply
Reset



3DEXPERIENCE

DELMIA Robot Programming Essentials

Search

Arunas Urbsys
My Industrial Design

Physical Product00024086 Manufacturing Cell000240 R2000iC-210F A.1 (Explore) R2000iC-210F A.1

Teach Parameters

General

Target Type: Joint

Active TagGroup:

Tag Prefix: Tag

Home Name: New Home

Target Reference: Absolute Relative Offset

Coordinates Referential: Context

Create / Modify targets based on: Robot TCP

Show Task 3D visualization

Profiles

Controller Profiles

Tool: UTOOL_NUM=0

Motion: 50%

Accuracy: FINE

Object: UFRAME_NUM=0

Motion

Simulation

Teach(R2000iC-210F A.1)

Index	Name
	RobotTask

Row Count: 0

Messages Reporting

[R2000i...

No	Message
1	Robot is in singularity!!
2	Robot is out of singularity
3	Point is unreachable
4	Point is reachable
5	Robot is in singularity!!

Robot is in singularity!!

U W V

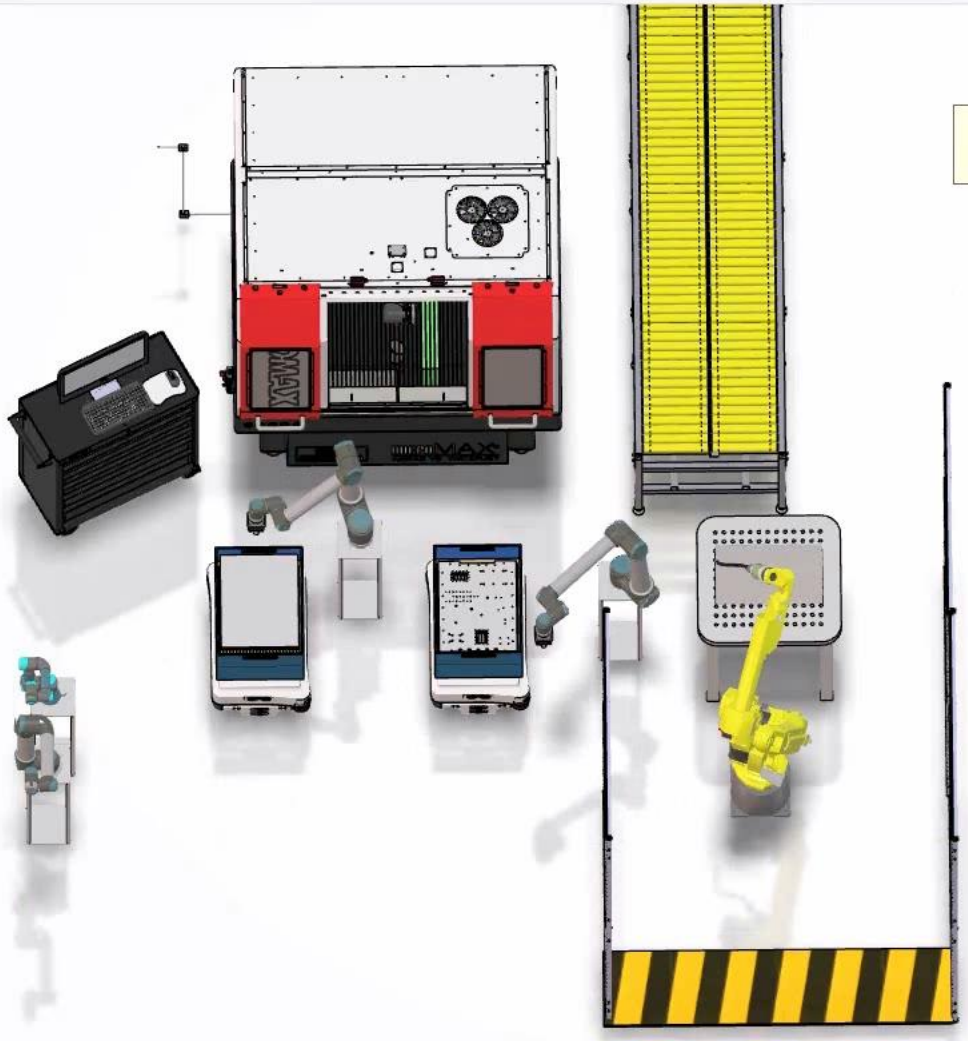
Standard Setup Programming Arc Analysis & Output PPR Standard Selection mode View AR-VR Tools Touch

18:17

Sequencing

Resource

- Robotics programming essentials A.1
  - Full_Simulation
  - SolidWorks Cell.1
  - Cell Welding.1



Check the "Link to Object" column to see which state was applied during simulation.
2 message(s) have been reported.
Open Messages Reporting for more details.

Nominal State

State.2

Standard | Setup | Programming | Arc | Analysis & Output | PPR Standard | Selection mode | View | AR-VR | Tools | Touch | Player

0.9s

Play

Manufacturing Innovations for Smart Cities

3D Reality Modelling
VR and Visualization
Services

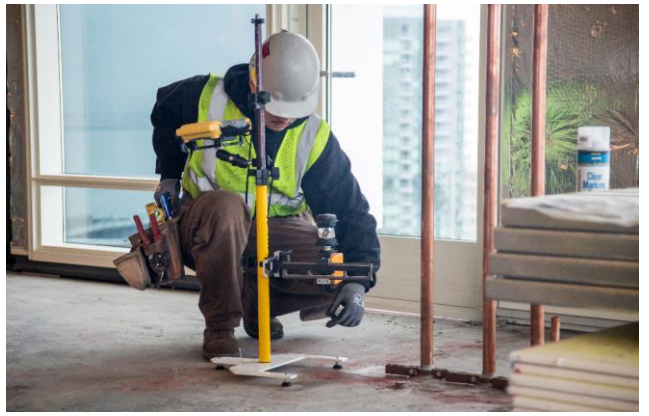
Autonomous Drone
Charging and Flight
Control Systems

Virtual Twin
Services for
Smart Cities

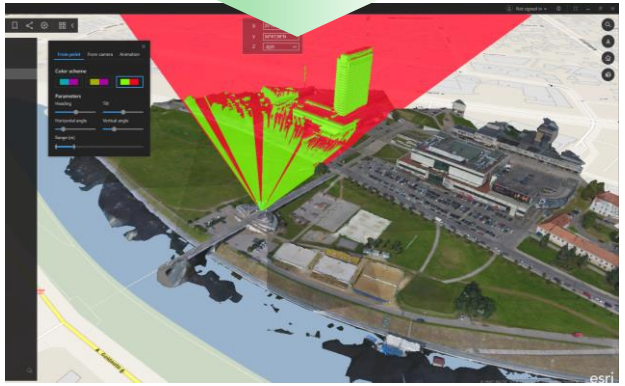
Integration of Surveying, Reality Modelling, BIM, GIS, and VR Technologies

Creation of Reality Context

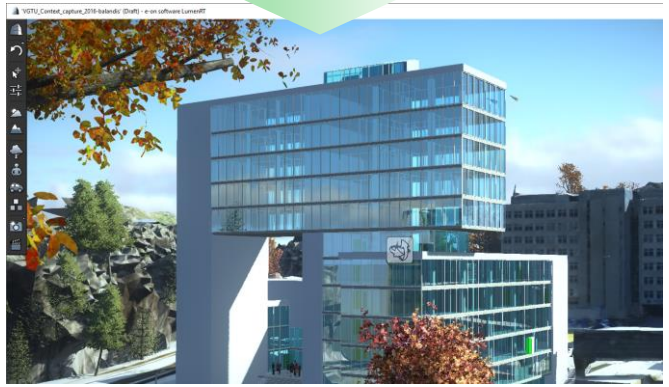
Integration of BIM models



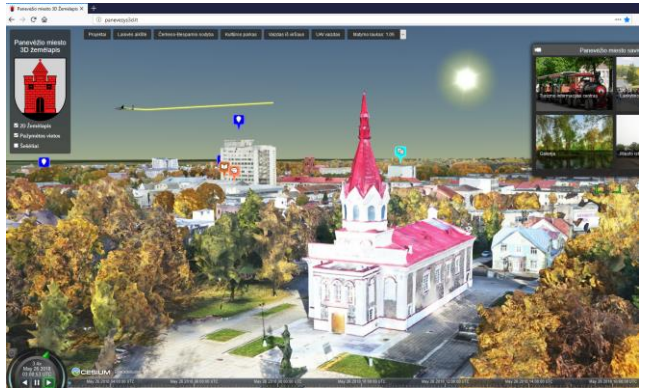
Construction Management



Integration with GIS



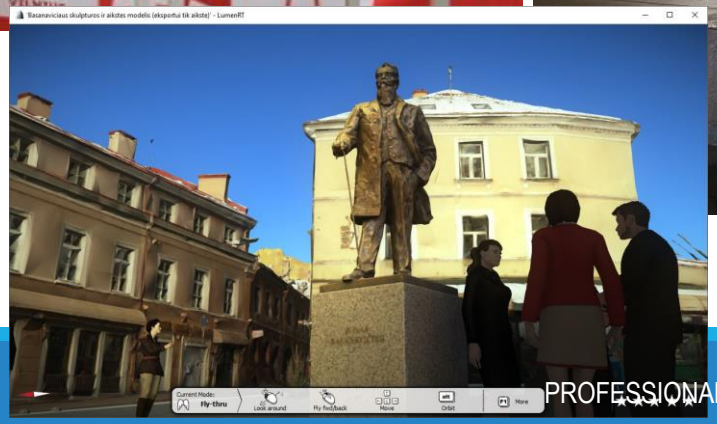
Visualization



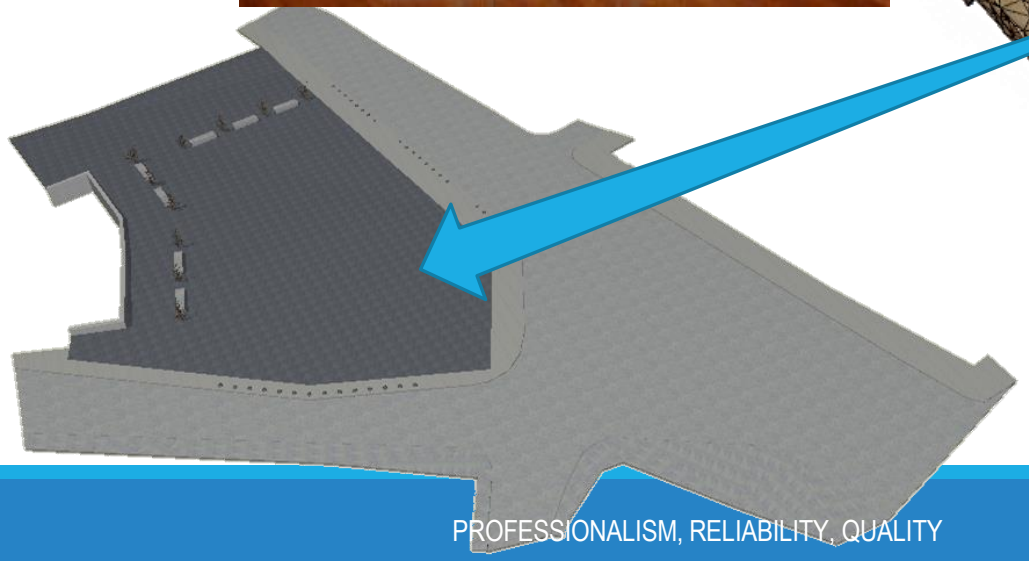
3D Smart Cities

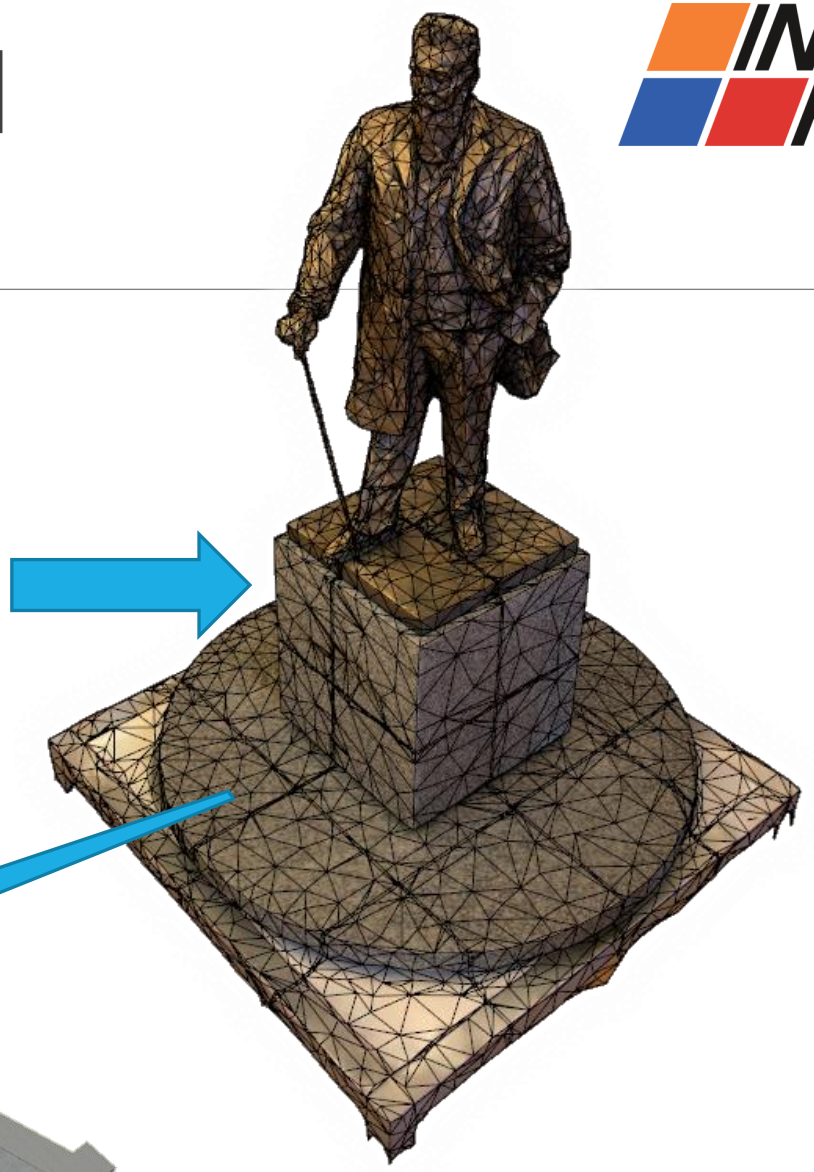
2016.11 – 2017.02

3D live visualization of public competition projects for J. Basanavičius monument in Vilnius



Integration of Photogrammetry and 3D Architectural Design






Gaublys
Pateikimas 010012
Pateikimas 010012
Pateikimas 182627
Pateikimas 180216
Pateikimas 604072
Pateikimas BS1905
INFRE
DRONE TEAM

2017
Live Virtual Reality Model for New Apartment Building at Saltoniškių str. 44 in Vilnius

Fly-throug Video Demonstration
https://youtu.be/oSGyZBgpZik


JP architektūra
Current Mode:
Fly-thru
Look around
Fly fwd/back
Move
Orbit
More
Auto

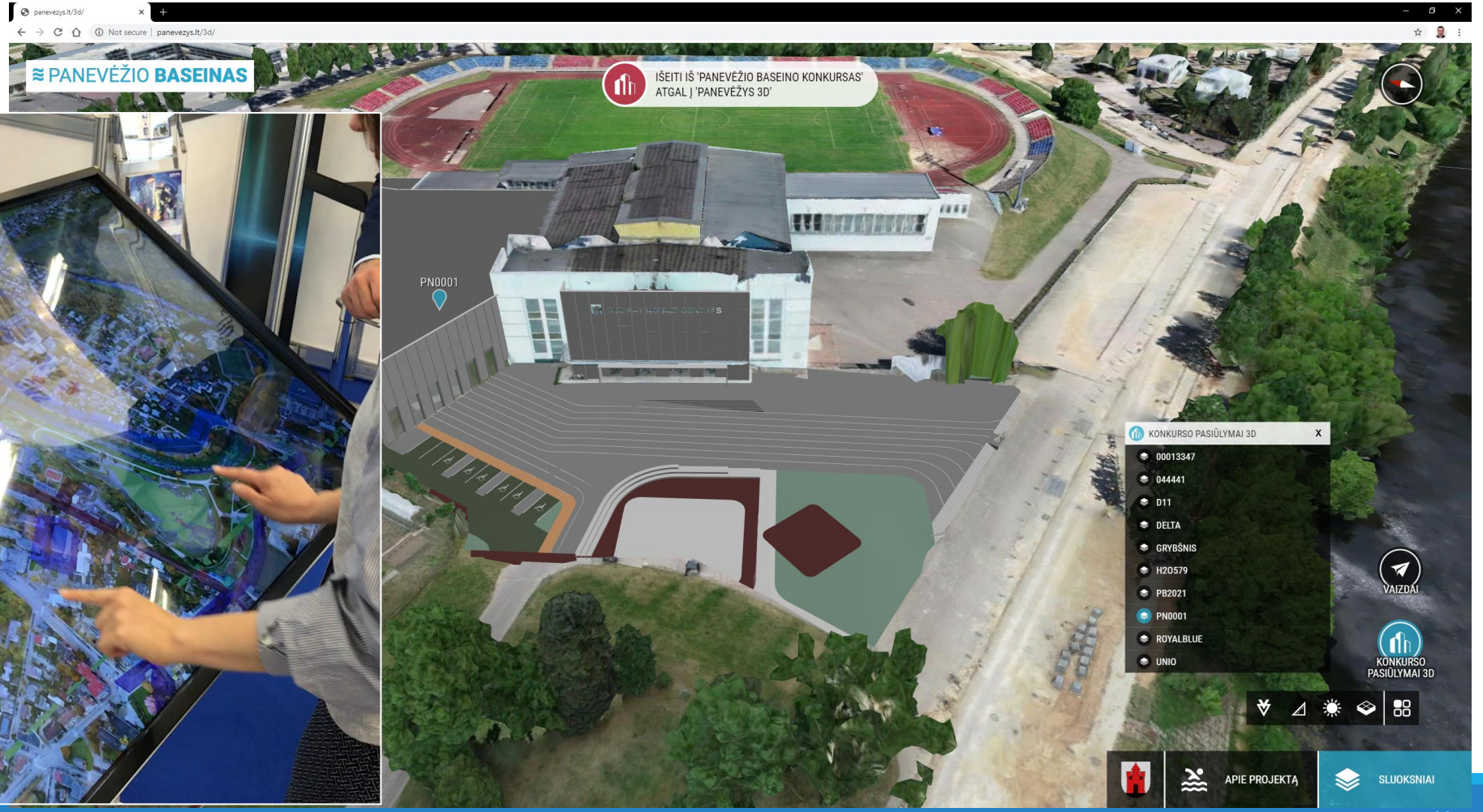
2017-2018 Cesium 3D Web 2019 OpenCities Planner

Panevėžys city 3D model – the first example of city-scale integration of GIS, BIM and VR technologies in Lithuania

See it live at https://panevezys.lt/3d or Video demo https://youtu.be/x94YinybcR0

Panevėžys 3D

Public architectural competitions within the context of 3D reality model
Informing the Citizens, involving them into Municipal decision-making




www.panevezys3d.lt
OpenCities Planner
Baseino konkursas
SEMC konkursas
Panevėžio krašto tyros muziejus
Gabrielės Petkevičaitės-Bitės viešoji biblioteka
Juozo Miltinio dramos teatras
Panevėžio m. savivaldybės administracija
MOVE
ZOOM
TILT & ROTATE
Switch to touchpad
VAIZDAI
MIESTO VYSTYMO PROJEKTŲ RIBOS
MIESTO VYSTYMO PROJEKTAI 3D
DRONE TEAM
APIE PROJEKTĄ
ĮRANKIAI

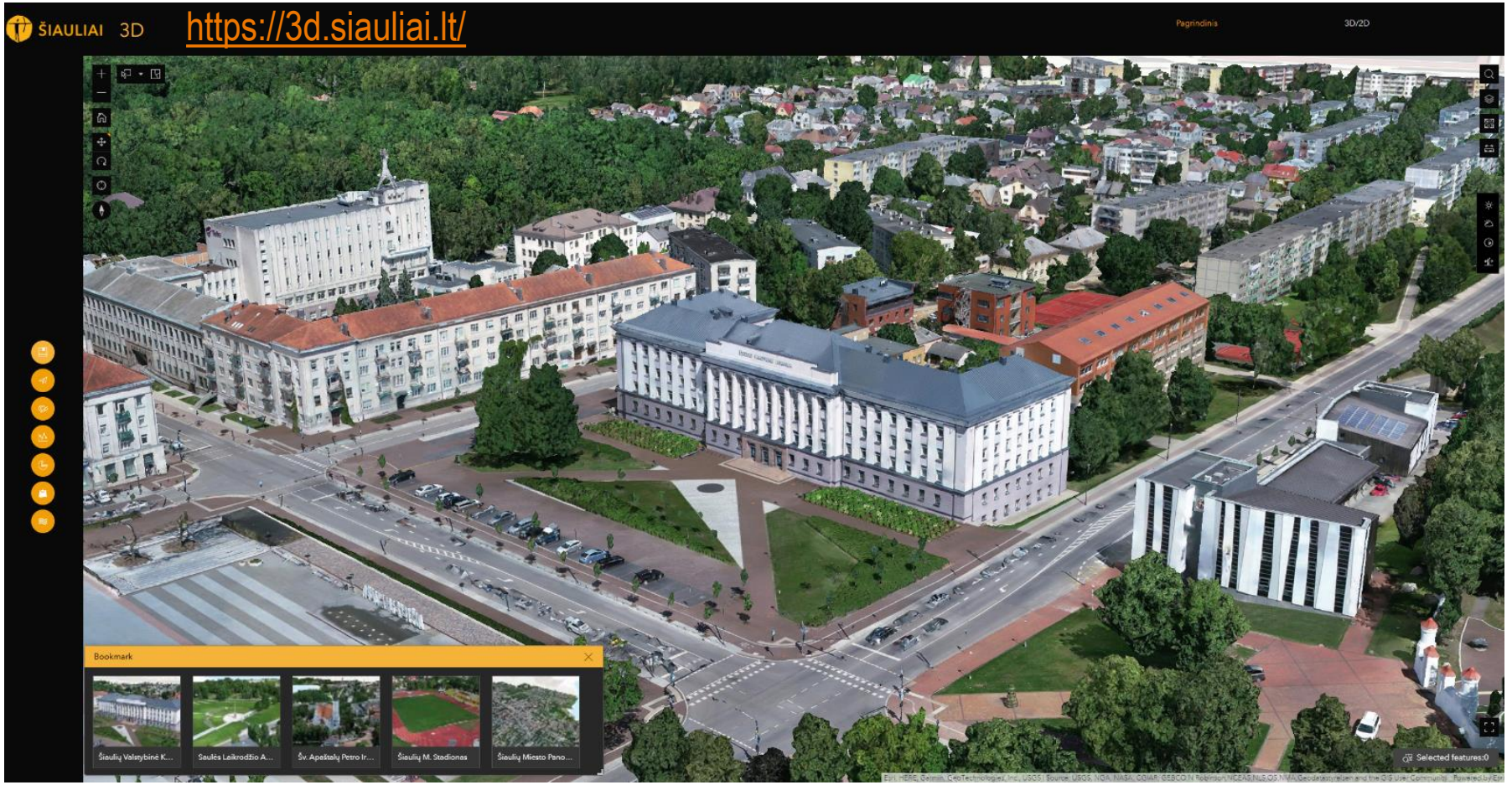
Detail resolution of 3D Reality Model: 5-7,5 cm. (individual objects - up to 3 cm)

Compare:
Traditional geodetic topo map at scale 1:500 delivers
1 mm = 50 cm detail.

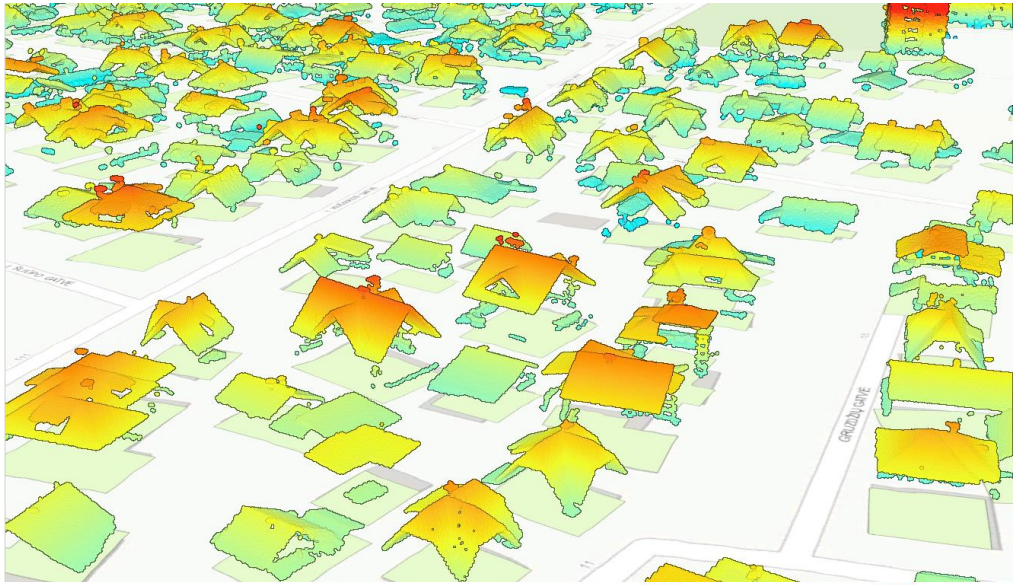
At graphical precision of 0,1 mm
a human can read topo data
at maximal detail of 5 cm.

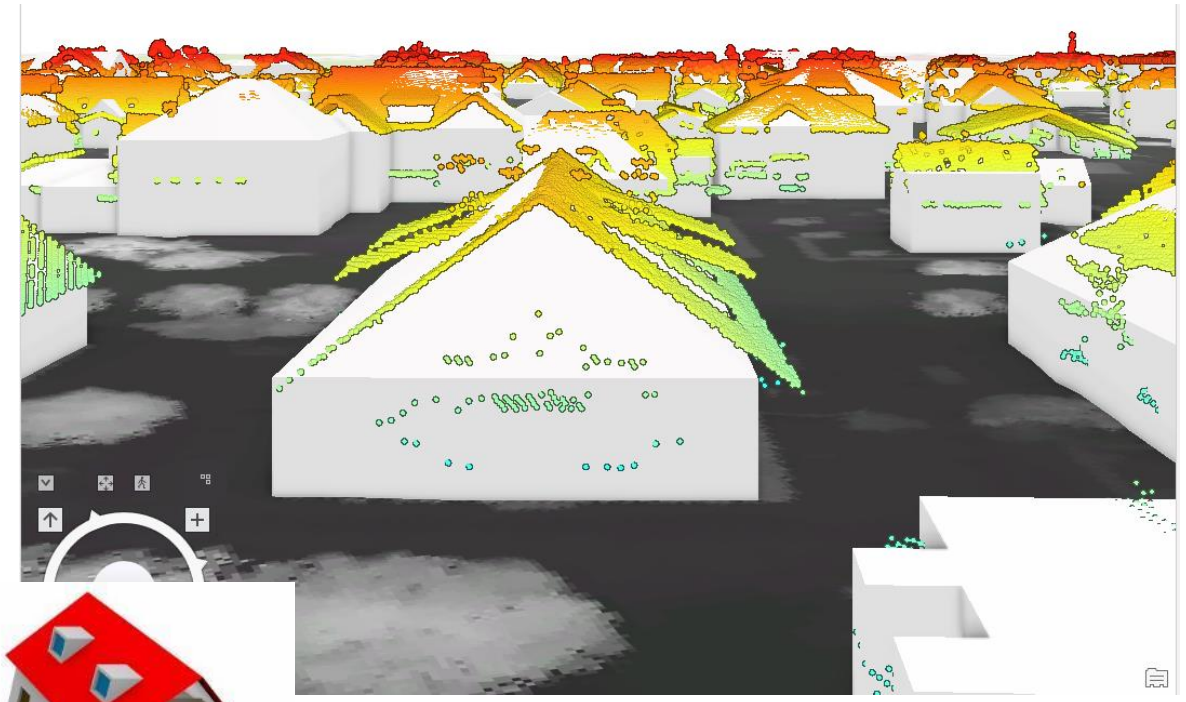
IN RE
Computer-Aided Engineering Services

2022
Šiauliai City 3D model – mixed technology: LiDAR, AI, Photogrammetry and BIM integration



Šiauliai City
AI: Generation of LoD 2.0 3D building models from LiDAR data



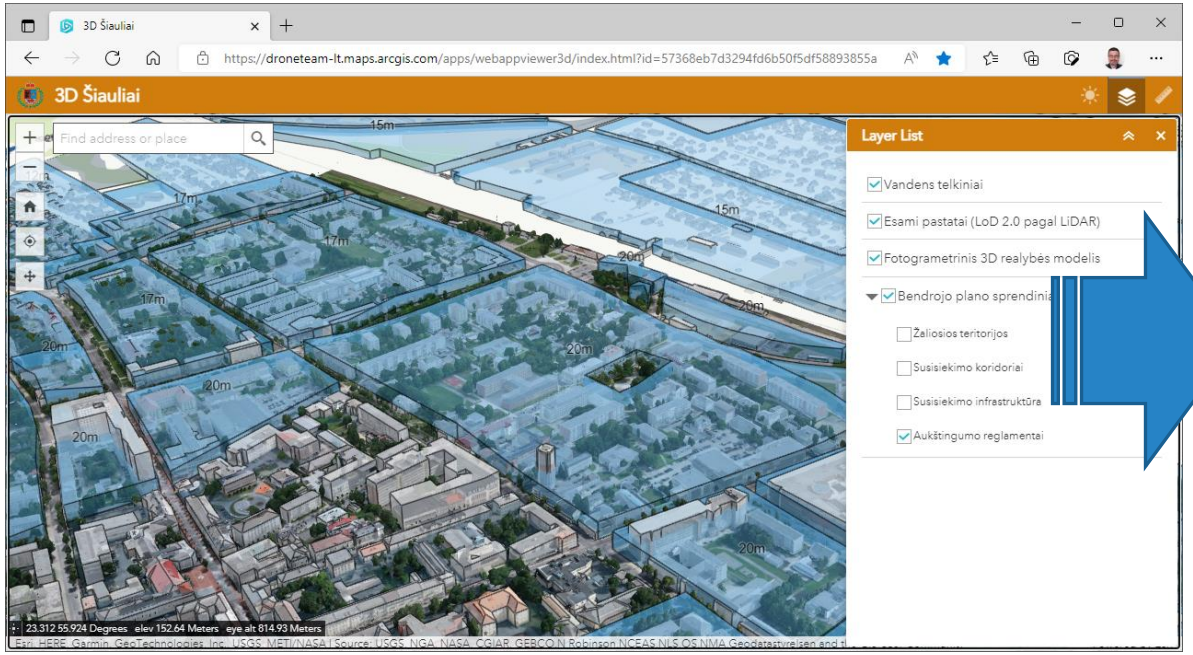


Šiauliai City

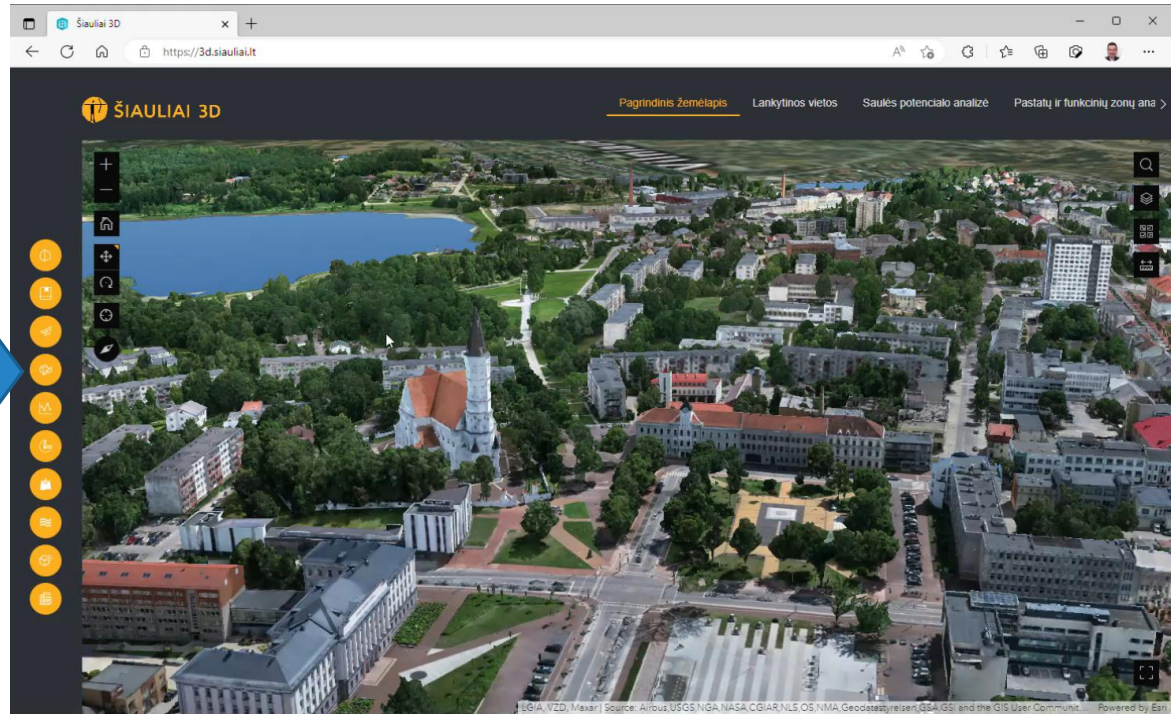
Aerial Photography from Drones and Photogrammetric Modelling

Šiauliai City
Web application

Work in Progress version (ArcGIS Online)

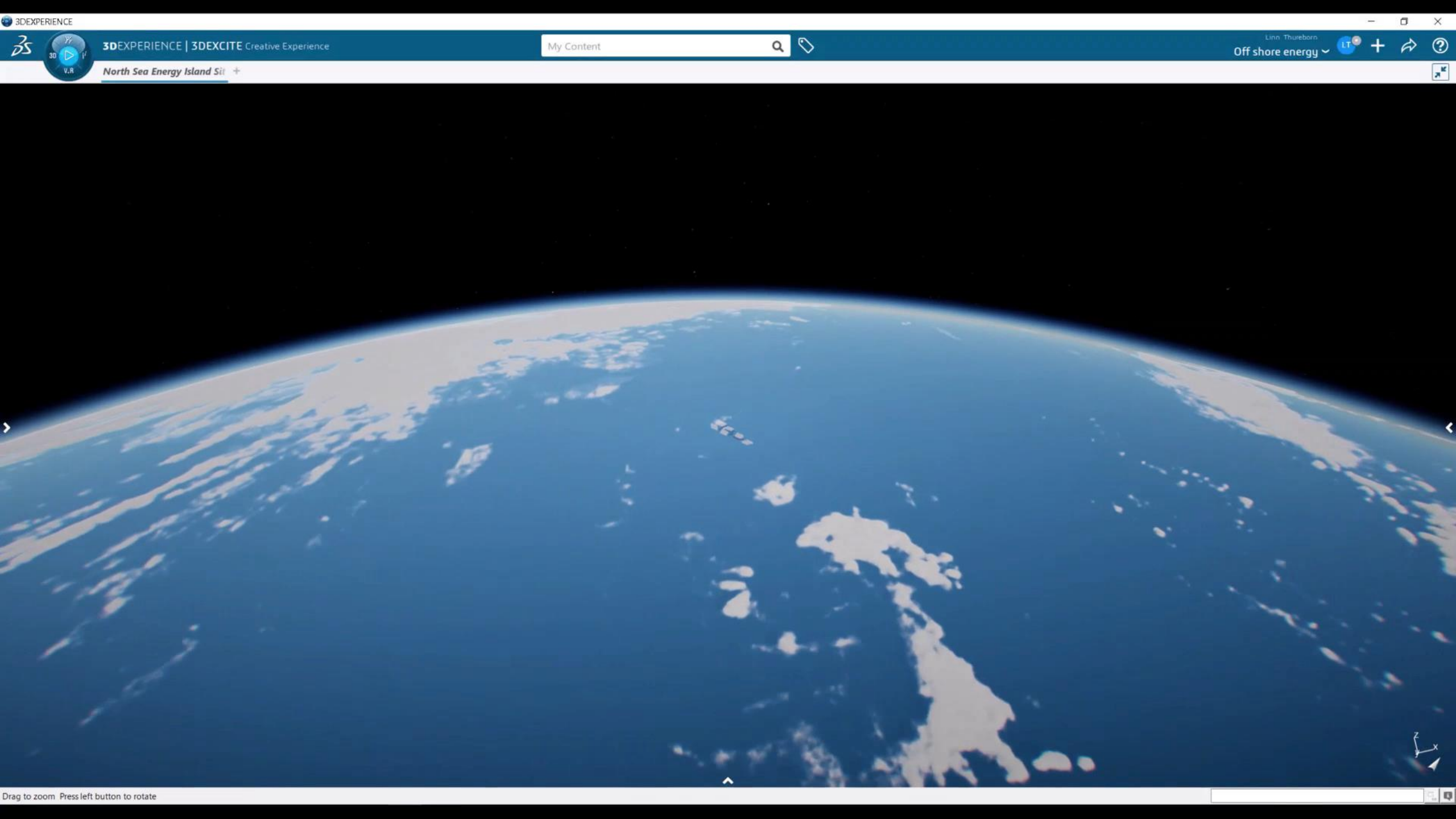


Published version (ArcGIS Experience Builder with React)



2019-2020
Investment-Representation 3D Model and Operational Monitoring System of Klaipėda Free Economic Zone

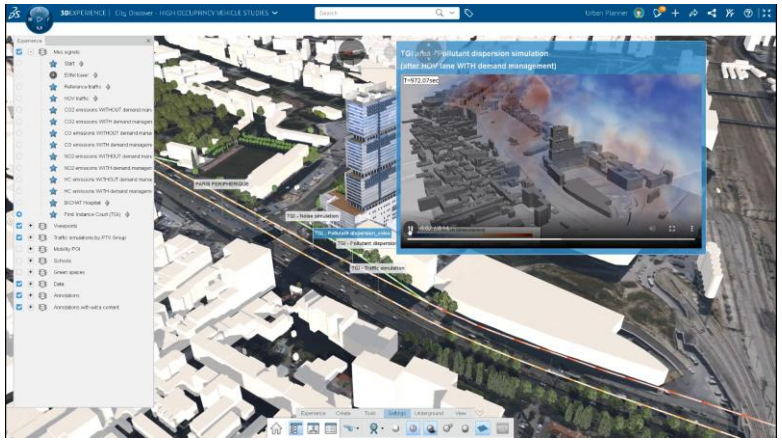

Klaipėdos LEZ reprezentacinis 3D
eu.opencitiesplanner.bentley.com/lt/klez
KLAIPĖDOS
LAISVOJI EKONOMINĖ ZONA
https://youtu.be/GiNmT6vXQDE
FEZ 3D
Video Demonstration
OpenCities Planner
Flex Start Two, UAB
VAIZDAI
360°
EN
LEZ RIBA
SKLYPAI
LEZ ĮMONĖS
PROJEKTUOJAMOS KOMUNIKACIJOS
POŽEMINĖS KOMUNIKACIJOS
TOOLBAR
ŠEŠĖLIAI
09:00
12
JUL
PATEIKITE ATSILIEPIMĄ
PERŽIŪRĖTI ATSILIEPIMUS
APIE
ĮRANKIAI

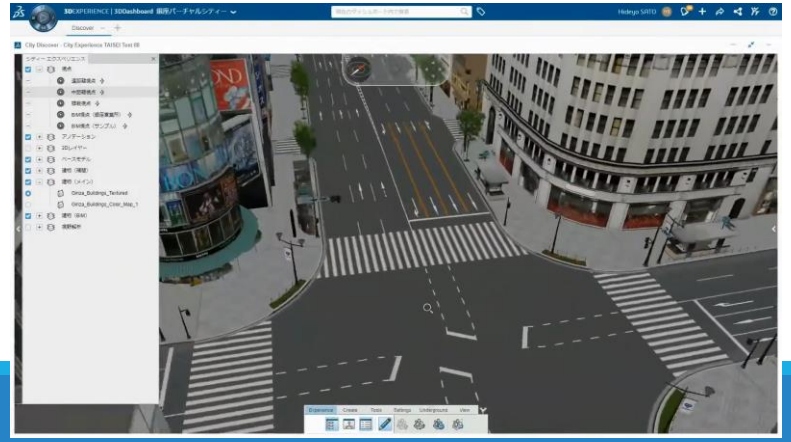

3DEXPERIENCE
3DEXPERIENCE | 3DEXCITE Creative Experience
My Content
Linn Thureborn
Off shore energy
North Sea Energy Island Sit
Drag to zoom Press left button to rotate

The North Sea: The Green Powerplant of Europe
Esbjerg Declaration
65GW by 2030
150GW by 2050
60GW by 2040
300GW by 2050
Links to international energy systems
Extra-small Nuclear Reactors
On-shore Wind Farms
Power to X
Solar
Urban
Mobility
Reinvigorated coastal communities
The project brings work and income for our local community.
1 The need for Wind Farm's is driven by regulatory, environmental and geopolitical drivers for renewable and reliable green energy.
7 The 3DX platform facilitates the operation of Smart Ports, ensuring they are able to manufacture and supply the right components, to the right location, at the right time.
SMART Ports
3DX allows us to make on-site design and specification changes...
3DX shows us where to deliver these components...
3DX enables us to collaborate with other partners and stakeholders...
3DX tells us when we can expect deliveries to site...
3DX enables us to record the results of our Environmental Impact Analysis...
8 The 3DX platform's ability to coordinate large modular infrastructure projects, combined with its close alignment with the Value Pathway, enables 3DS to deliver the accelerated timelines needed to generate renewable green energy from 2030.
5 The 3DX platform is cloud-based, providing digital data continuity and a single source of truth across Wind Farm construction projects.
Single Source of Truth
Data
VIRTUAL TWIN
HVDC
OPERATE
COMMISSION
BUILD
SURVEY
CONNECTION POINT CONSTRUCTION
WIND FARM CONSTRUCTION
3DX provides us with an on-site dashboard of the Wind Farms performance...
2 The Value Pathway to construction of Wind Farms is complex and lengthy, requiring many stakeholders to collaborate effectively.
4 The 3DX platform provides a virtual twin of the Wind Farm, providing a real-time 3D view of every component, system and process and its current operational status.
6 3DX is an integrated platform coordinating the design, build, commissioning, operation and maintenance of Wind Farms.
WIND FARM MODULES CAN BE CONSTRUCTED CONCURRENTLY USING A PHASED APPROACH TO ACCELERATE TIME TO INITIAL AND SUBSEQUENT POWER GENERATION GOALS
MODULAR CONSTRUCTION
Maritime space managed sustainably
Artificial reefs
Oyster farming
Scour Protection
Seaweed farming
3DX helps us plan at both the macro and micro levels across multiple complex projects...
VALUE PATH
PLAN >>>
DESIGN >>>
BUILD >>>
COMMISSION >>>
OPERATE & MAINTAIN >>>
PROJECT MANAGEMENT
COLLABORATION BETWEEN ALL STAKEHOLDERS
LICENCE TO OPERATE
EQUIPMENT CARE
CATIA
3DEXCITE
GEOVIA
SIMULIA
ENOVIA
NETVIBES
DELMIA
3D
V+R
NETVIBES provides with a whole project performance dashboard...
• Regulatory & permit management
• Environmental impact analysis (EIA)
• Convincing investors
• Winning public opinion
FEASIBILITY STUDIES
• Terrain implantation
• Initial asset performance simulations
• Lifecycle assessment (LCA)
FACILITY DESIGN
3DX allow us to design and simulate each
VIRTUAL TWIN
• Improved lifecycle decision making
• Coordination of multiple projects
The VIRTUAL TWIN
ASSET CARE
• Predictive maintenance
• Reliability focus
3DX allows us to anticipate, plan and schedule maintenance activity efficiently...
...and respond to real-time issues immediately.
EMERGENCY RESPONSE
ANTICIPATION
KEY DRIVERS OF ENERGY

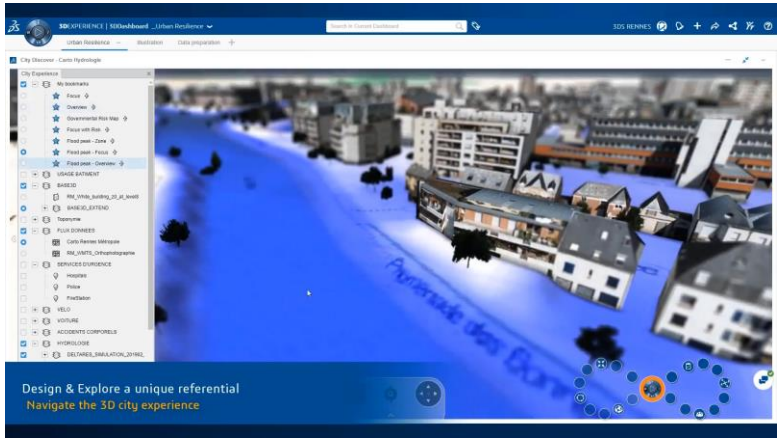
What's next? Industrial Simulations with Virtual Twins for Smart Cities

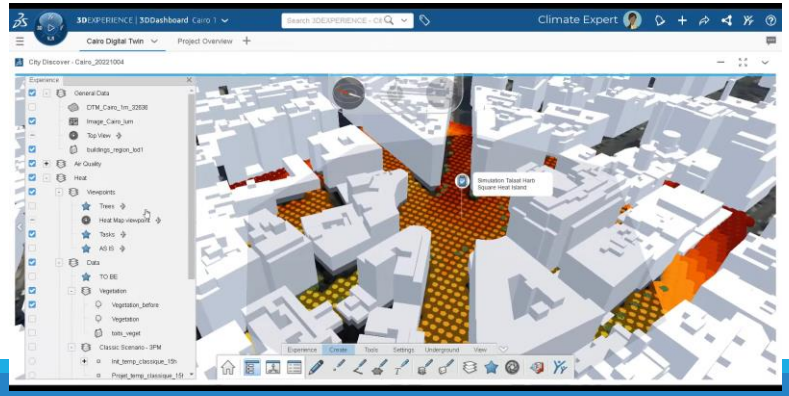
Traffic, Polution and Noise Simulations for Safety



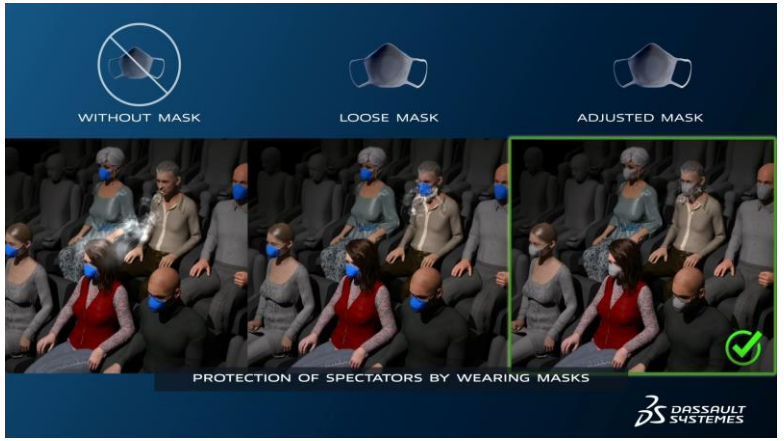


Flood and Heat Simulations – Impact of Climat Changes



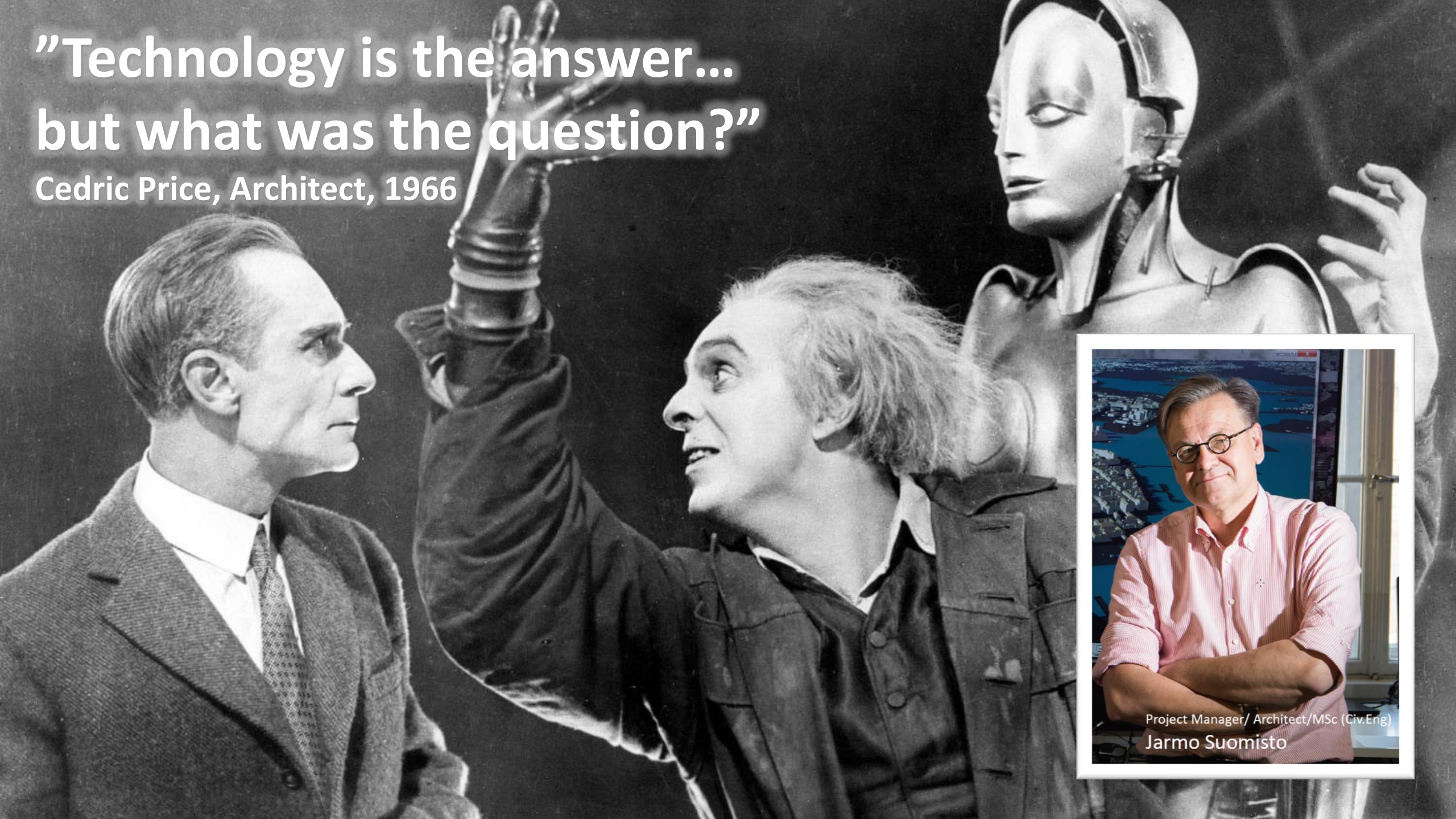


Airflow Simulations for Healthcare and Wellbeing



”Technology is the answer… but what was the question?”

Cedric Price, Architect, 1966



Project Manager/ Architect/MSc (Civ.Eng)

Jarmo Suomisto

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Virtual Twin Lab developed by:

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Computer-Aided Engineering Services

DASSAULT SYSTEMES

Manufacturing Innovations Valley
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LT-14332 Vilnius
LITHUANIA

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