

AR/VR for European Space Programmes

Digital continuity applied to space sector



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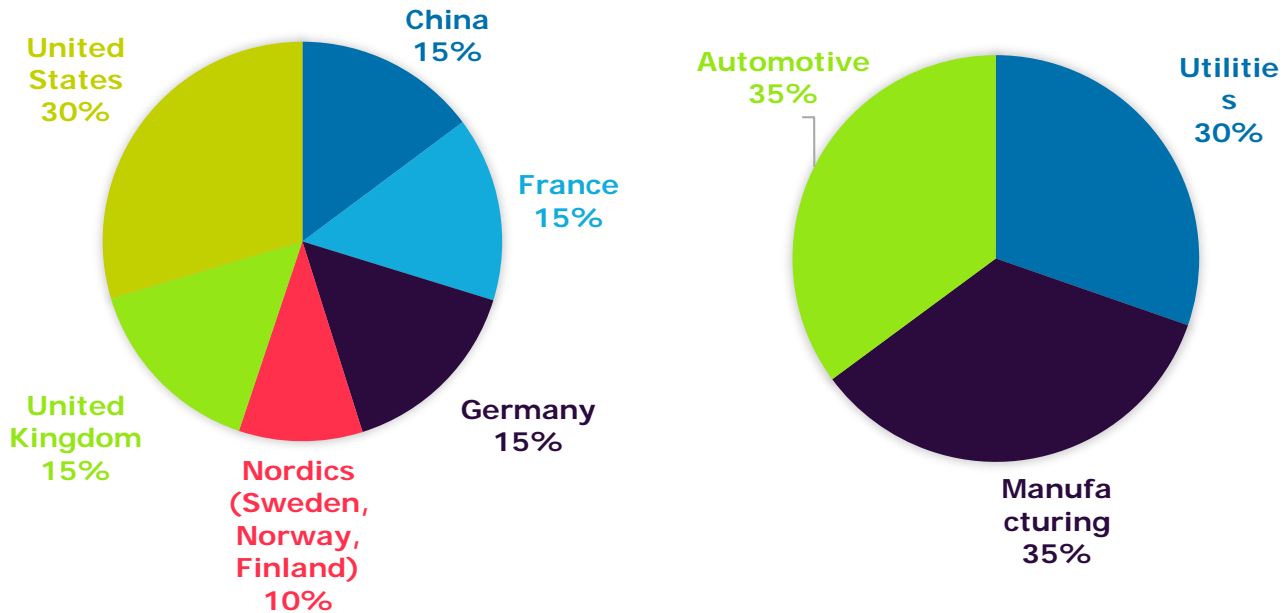
XR Market maturity analysis

Governance and Digital Continuity
Guidelines for upscaling

AR in Manufacturing Assembly
Integration and Testing domain

Research scope and methodology – Survey and Interviews

Survey of 700+ Executives in the Automotive, Utilities, and Manufacturing Sectors



Source: Capgemini Research Institute, Augmented and Virtual Reality Survey, May-June 2018

The Survey

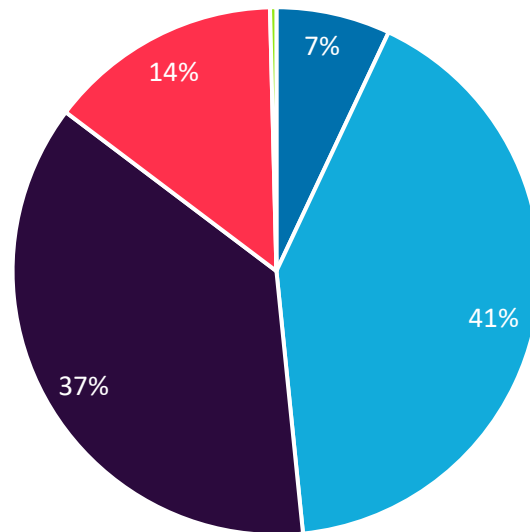
- We surveyed **700+ executives from automotive, utilities, and manufacturing sectors** during May-June 2018
- Each of our surveyed companies has **annual revenue of USD \$0.5 billion or more**, and **70% of them earn from USD 1 billion to USD 10 billion** annual revenue

Focus Interviews

In addition to the survey, we held **over 25 in-depth discussions** with members of academia, executives at global companies, and AR/VR software providers.

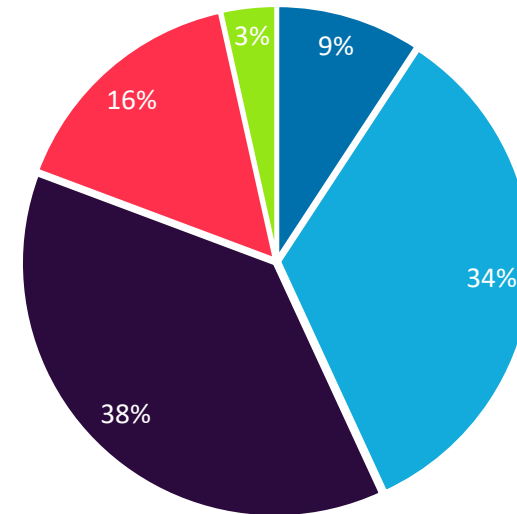
Majority of respondents indicate that AR/VR will become mainstream within the next 5 years

Augmented Reality



- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years
- I don't have enough information to answer this

Virtual Reality

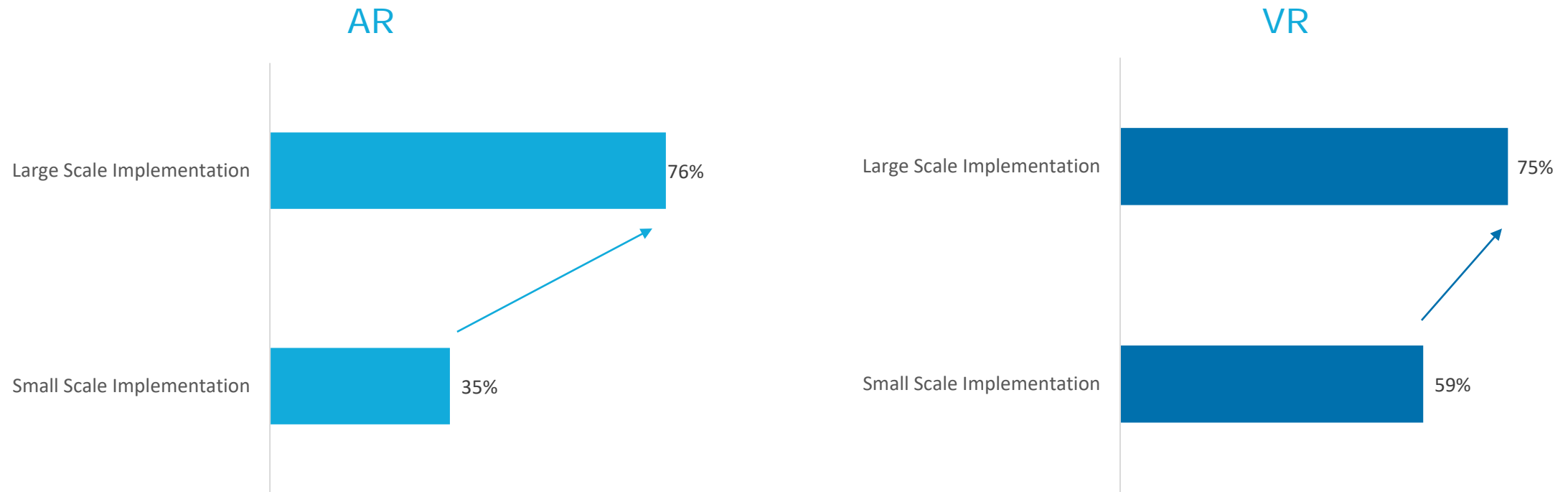


- Less than 1 year
- 1-3 years
- 3-5 years
- More than 5 years
- I don't have enough information to answer this

Source: Capgemini Research Institute, Augmented and Virtual Reality Survey; May-June 2018, N=603 organizations that are exploring and implementing Augmented Reality and Virtual Reality.

Three in four companies with large-scale AR/VR implementations attest to operational benefits over 10%

Share of organizations deriving more than 10% operational benefit, by category



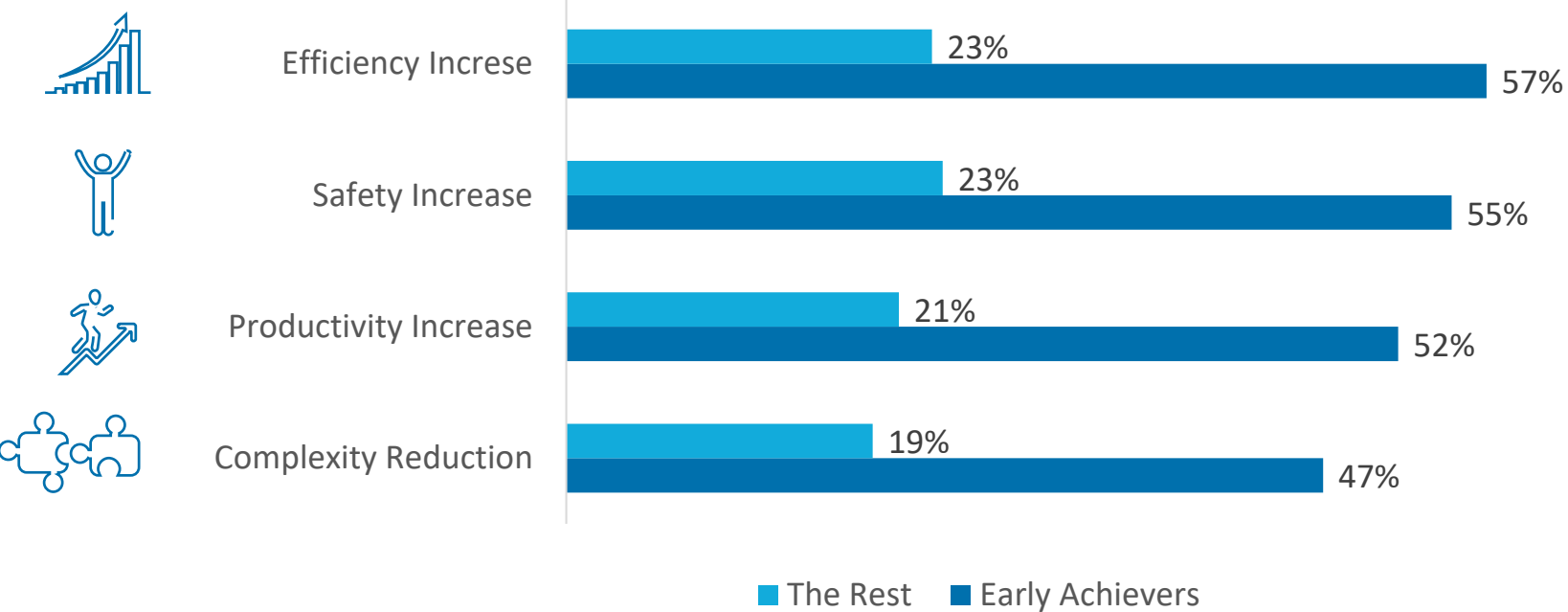
Global Data

Source: Capgemini Research Institute, Augmented and Virtual Reality Analysis; N=152 and 275 organizations implementing at least two Augmented Reality use cases at large scale and small scale, respectively; N=116 and 220 organizations implementing at least two Virtual Reality use cases at large scale and small scale respectively.

Early achievers drive higher benefits as compared to the rest



Share of organizations globally that witnessed benefits of more than 10% on average



Global Data
Source: Capgemini Research Institute, Augmented and Virtual Reality Survey; May-June 2018, N=603 organizations that are exploring and implementing Augmented Reality and Virtual Reality; N=134 Early Achievers



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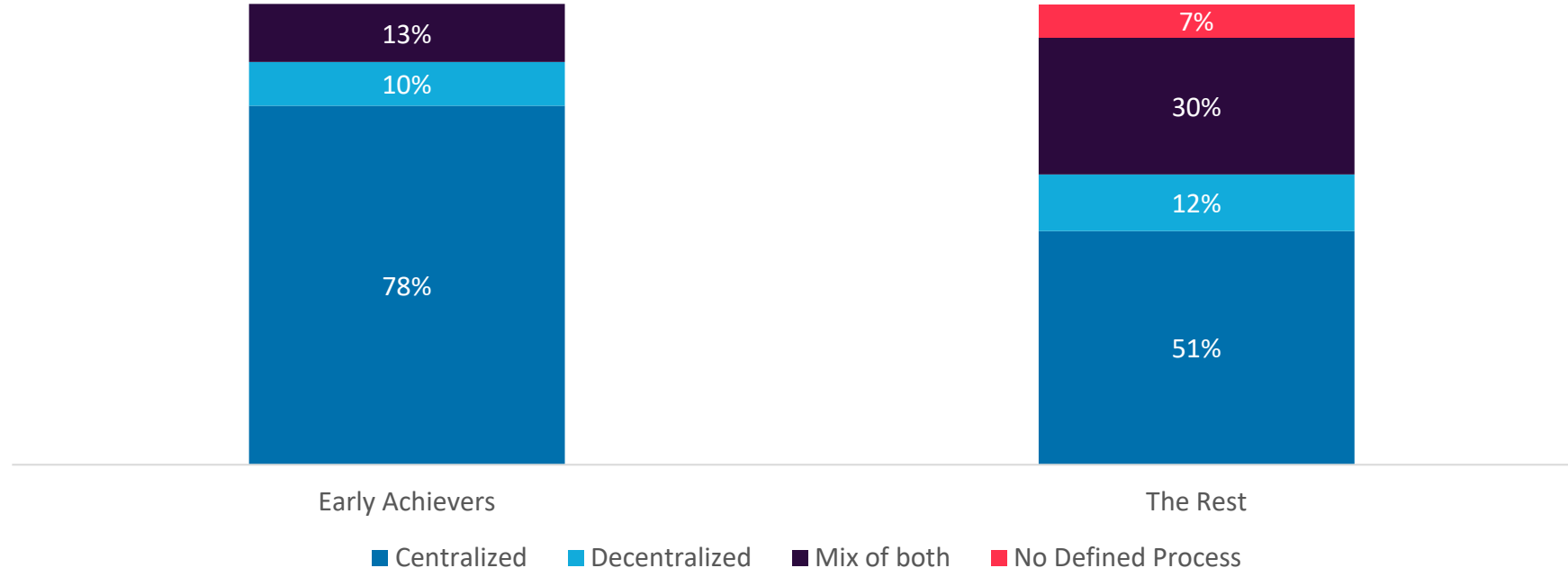
To become AR-VR achievers, organizations can follow a set of steps that have set early achievers apart

- Develop a **centralized governance structure** with all AR/VR activities coordinated by a team and build AR/VR awareness
- Focus on **identifying the 'right' use case** that provides lasting **value** and **support employees** in this journey
- **Prepare technology infrastructure** to integrate AR/VR
- Consider integrating XR projects in a **3D Digital Continuity** approach to maximize efficiency

Develop a centralized governance structure with all AR/VR activities coordinated by a team



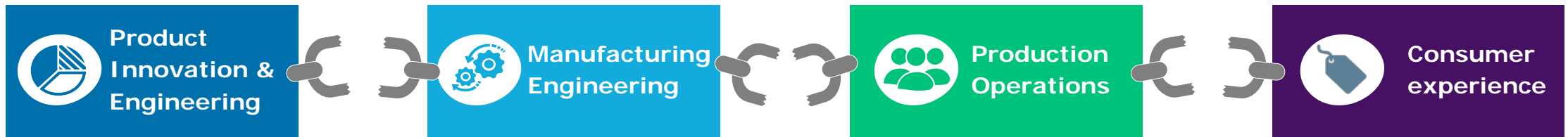
AR/VR Governance Structure, Early Achievers vs The Rest, Global



Global Data


Source: Capgemini Research Institute, Augmented and Virtual Reality Survey; May-June 2018, N=603 organizations that are exploring and implementing Augmented Reality and Virtual Reality; N=134 Early Achievers

XR projects are often managed in silos with limited Digital Continuity throughout the manufacturing lifecycle



Immersive contents for training, production or maintenance are **created manually** from CAD models designed in Engineering, but **not linked to the PLM**, which is a break for upscaling

- 
- Preparation time reduced instead of redesigning a new 3D model from scratch for XR content

- 
- Lack of traceability with the CAD model
 - Doesn't support the configuration management
 - XR Work Instructions or Training contents must be redesigned when a change occurs
 - Lack of obsolescence or versioning knowledge



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CONTEXT

- AIT Activities of Scientific Instruments, Payloads or Satellite (prototype):
 - SEIS (Insight Mission) Instrument, RPW (Solar Orbiter Mission) Instrument.
 - TARANIS Satellite

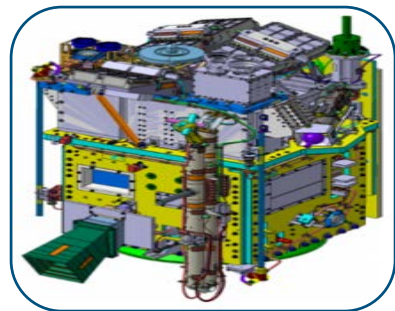


CONTEXT / OBJECTIVES

- AIT Activities of Scientific Instruments, Payloads or Satellite :
 - SEIS (Insight Mission) Instrument, RPW (Solar Orbiter Mission) Instrument.
 - TARANIS Satellite
- Digital Transformation from conception to realization activities in order to :
 - Link As-Design to As-Built (AIT Activities)
 - Provide access to all needed information in one interface for operators
 - Secure all AIT Activities (Duration, Reliability)

Architecture

Documentation / NCR Database

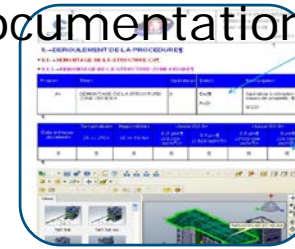


CATIA



ACCIO

AIT Documentation



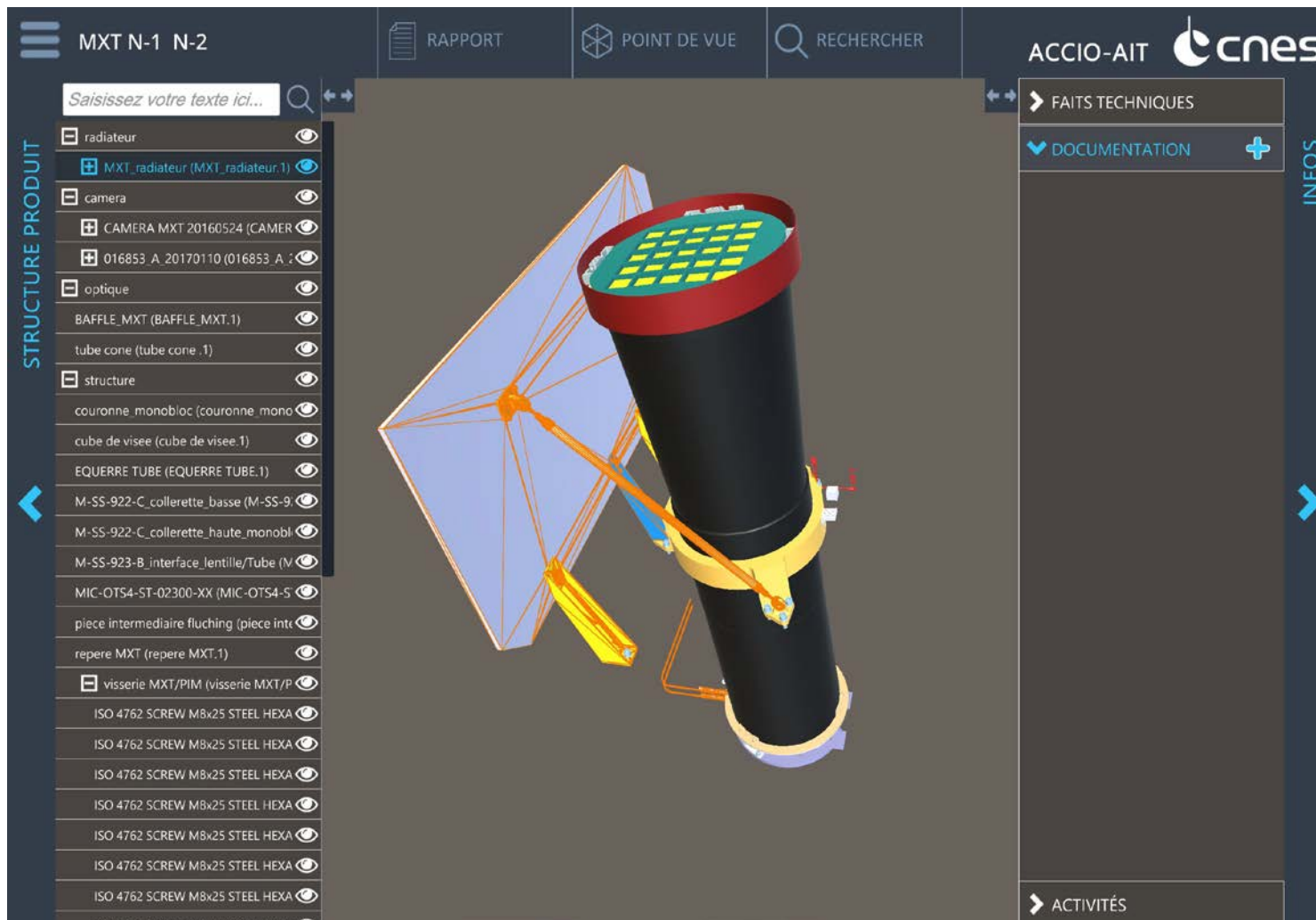
Connected tools (In Prospect)

DESIGN

REALIZATION



ACCIO

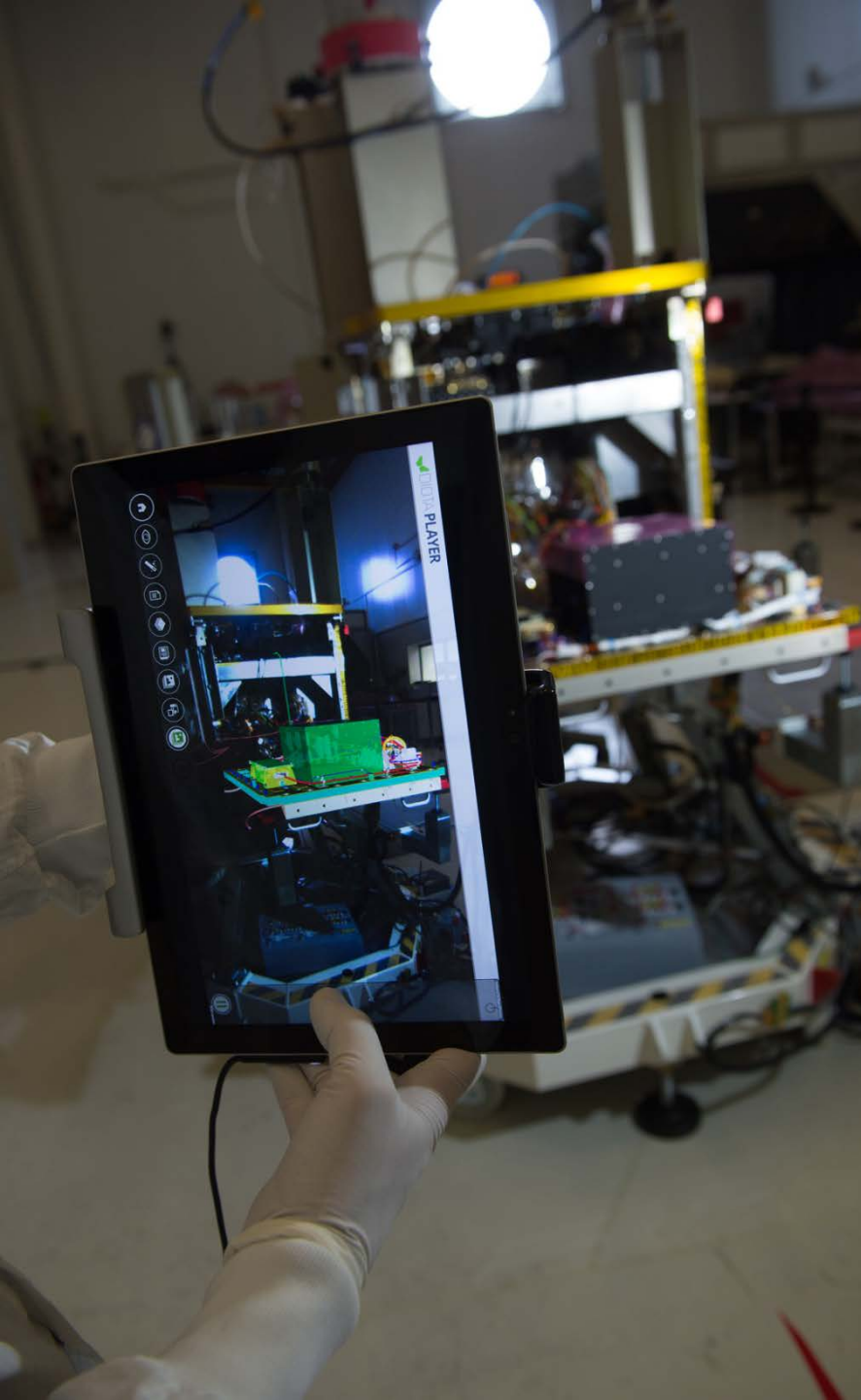


- Operator Interface for the visualization of 3D mockup
 - Need a File Conversion from Step to Fbx File
- AIT product tree management (different from design office)
- Configuration management of 3D mockup
- Connection with databases (Documentation, NCR)
- Access for multiple users
- Off-Line Mode
- Connection with AR Tools
 - Management of AR Project
 - Bidirectionnal data connection between ACCIO and DIOTA

Augmented Reality for AIT

Use cases:

- Equipments reception : Assistance to quality managers and equipment managers
 - Non conformity detection earlier
- AIT Activities : Assistance to AIT operators during assembly and integration activities
 - Time Saving / Errors reduction
- Quality Control: Facilitate quality control (AQI) to identify areas to be controlled
 - Time Saving / Reliability



Augmented Reality for AIT : DIOTA

CNES R&T in 2015 to evaluate AR solutions for AIT Activities within CNES context. Selection of the DIOTA Solution

- **Software:**

- Solution without Marker
- Need a learning phase
- Solution opened to user customization
- High performance in image Stability
- High performance in precision of localization of equipment (~ 1mm)
- high stability in case of deviation between reality and 3D mockup (~50%)



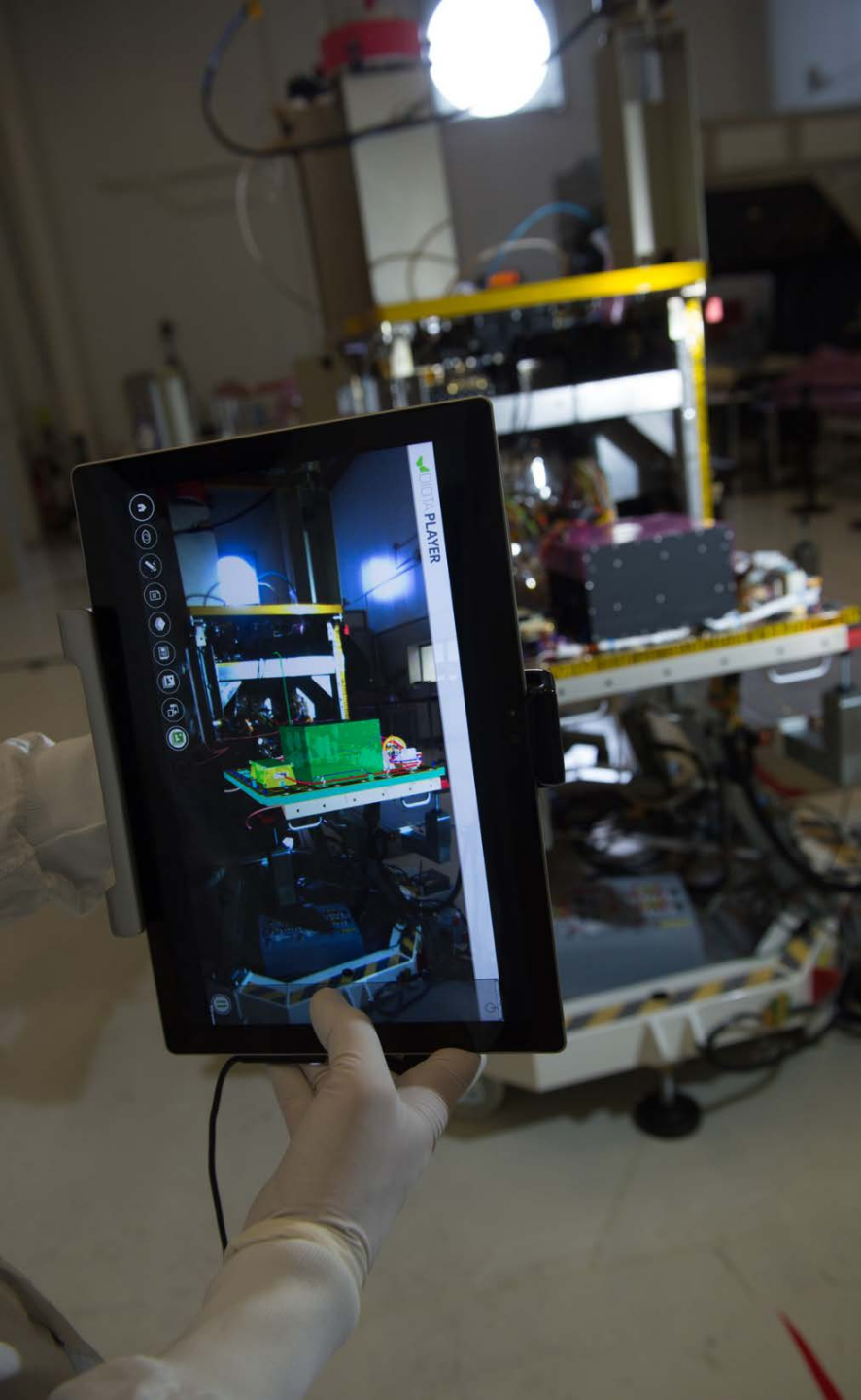
3D

Reality

Augmented Reality

- **Hardware**

- Tablet (Surface Pro) + Specific Camera
- Videoprojector System : Projection of the 3D mockup on surfaces for visualization of data in real time on systems.





People matter, results count.



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