



**ariane**GROUP

# Ariane 6 Exploitation Data Management in an Extended Enterprise Context

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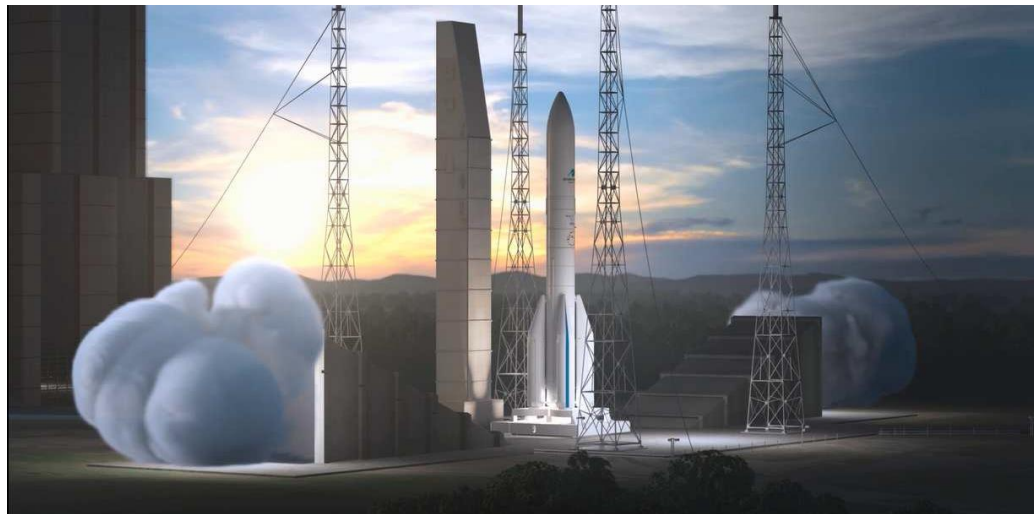
ArianeGroup

# ARIANE 6 OVERVIEW

Ariane 6 will be launched in 2020 for a Full Operational Capability (FOC) in 2023.

The launch system comprises:

- The launcher system:
  - a flying segment (system of interest),
  - a ground segment (production system and operation system),
- The launch range (Centre Spatial Guyannais - CNES)
- The Safety Authority (French state responsibility delegated to CNES)

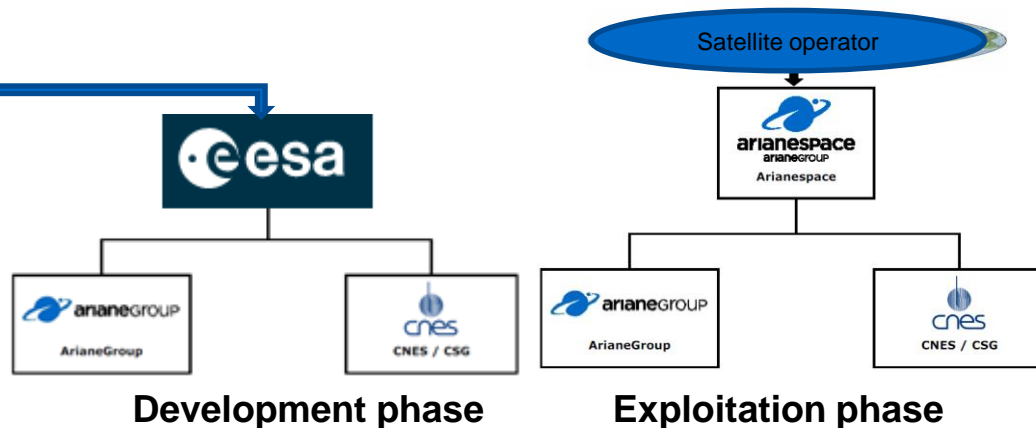


Ariane 6 is developed as an European Space Agency (ESA) program.

The launcher will place various types of payloads in:

- low Earth orbit (LEO),
- geostationary transfer orbit (GTO)
- or sun-synchronous orbit (SSO).

**Main targets : drastic cost reduction + mission versatility**  
(Multiple boosts, Spacecraft Volume)



# ARIANE 6

## A EUROPEAN INDUSTRIAL NETWORK ORGANIZED INTO CLUSTERS OF EXCELLENCE

### LAUNCH SYSTEM AND FINAL INTEGRATION

ArianeGroup

### BOOSTERS

ArianeGroup / Avio  
via Europropulsion / Regulus

### CRYOGENIC SYSTEMS

Air Liquide

### METAL AEROSTRUCTURES

MT-Aerospace  
Airbus DS Netherlands

### COMPOSITE AEROSTRUCTURES

Airbus DS (CASA)

### FAIRING

RUAG

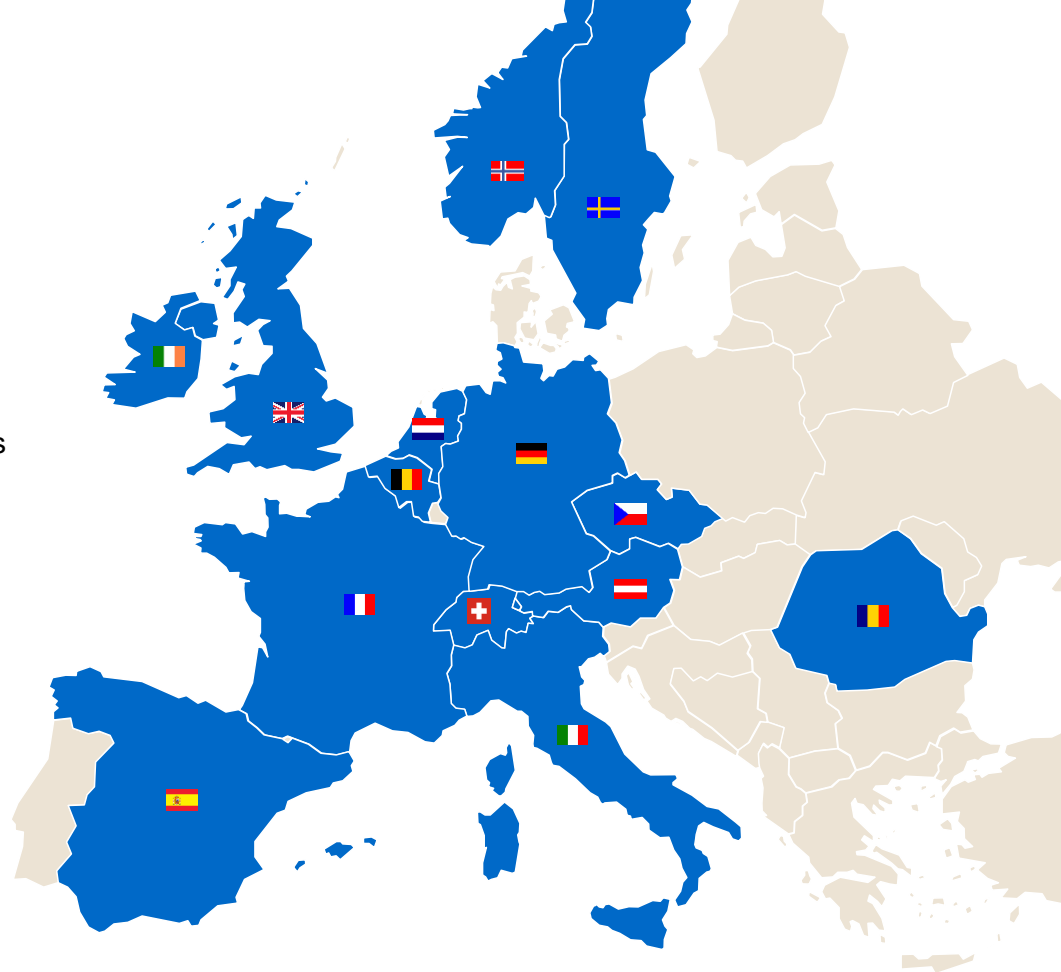
### MECHANICAL GROUND EQUIPMENT

APCO

### THRUST

### VECTOR CONTROLS

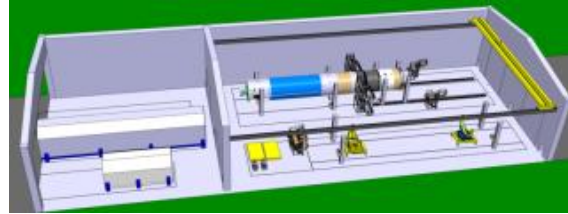
SABCA



# ARIANE 6 PRODUCTION SYSTEM

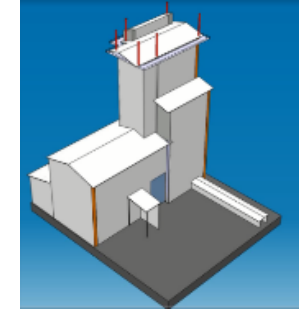


**Newly developed Launch Zone**  
Mobile Gantry: 100 meters high, 5.000 t



**Building Assembly Launcher**

- Horizontal assembly
- Crane less strategy



**Encapsulation Hangar**

- Re-use of Ariane 5 building

## LEAN, FLEXIBLE & INTEGRATED

- DIGITAL CONTINUITY
- CONNECTED PRODUCTION SYSTEM
- ADVANCED PROCESSES

**The industrial partners develop Ariane 6 in an extended enterprise approach, with standardised methods and tool.**

# EXPLOITATION DATA

**Exploitation data are generated or used during the exploitation phase:**

- **Configuration data (as designed and as built)**
- **Production data (assembling times, test records)**
- **Operation data (chronology, events)**
- **In-flight data transmitted via telemetry**
- **Post-flight analysis data**

# EXPLOITATION DATA MANAGEMENT USE CASES

- **Before launch, to monitor the launcher readiness and at the end to declare FLIGHT WORTHINESS**
- **All along the production cycle, to anticipate production drifts and support predictive maintenance**
- **To give feedback for continuous performance improvement of**
  - **The launcher configuration and filling,**
  - **The operations,**
  - **The design of the Production (Manufacturing, Assembling, Integration and Test (MAIT)) System**
  - **The design of the launcher system**

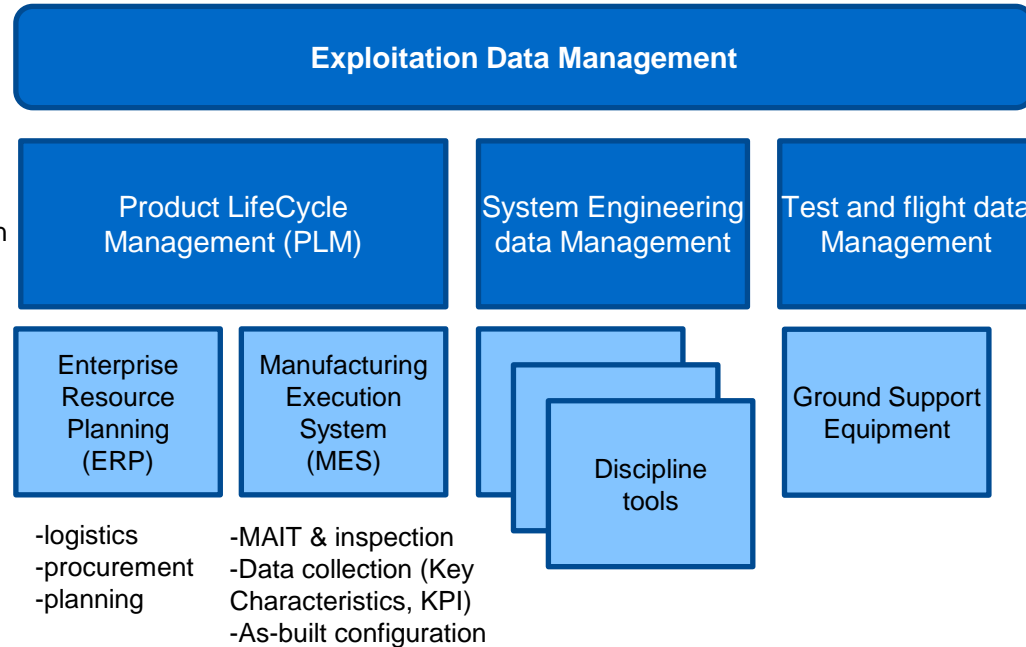
Demonstration for a given mission that all gaps w.r.t. qualified reference (including definition and flight domain) are acceptable for the launcher and for its payload to fly with targeted reliability and safety level.

Reduction of inert masses  
Validated margin policy  
Optimization of non-propulsive propellants

# EXPLOITATION DATA MANAGEMENT SCOPE

The Exploitation Data Management subsystem is part of the overall A6 information management system and ensures digital continuity

- Product / process information centralization
- EBOM/ MBOM synchronization
- Data collection centralization



# DIGITAL CONTINUITY OVER PRODUCT LIFECYCLE

## Objectives

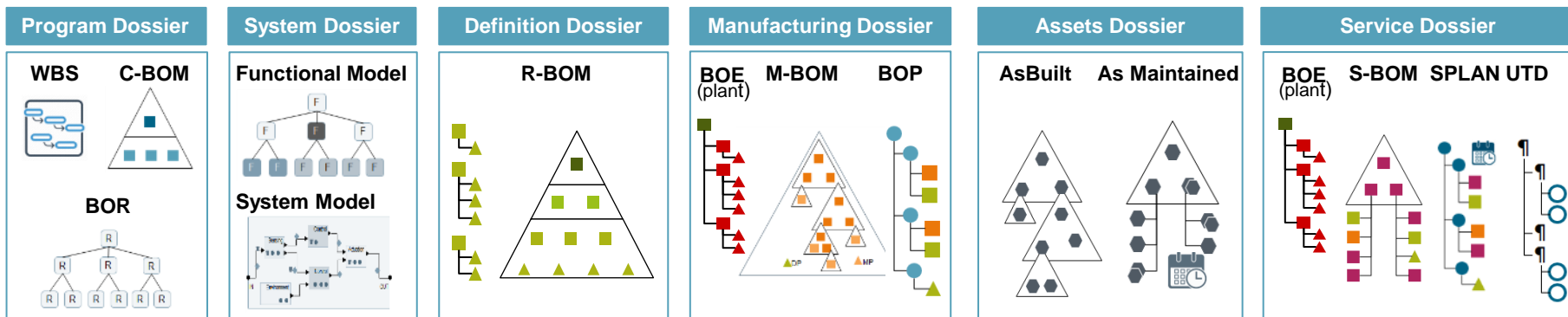
- Single Product Data Source
- Single Source of truth
- Access to qualified data for production
- Access to qualified data for flight worthiness & exploitation
- Reuse of Data & No Duplication
- Flexibility & Separation of concerns

## Multi-BOMs PLM

- Managing on configuration all A6 technical product & process data through Bills of Materials
- E2E Management of Check-Out Logics and Key Characteristics
- Product Digital twins: As-built /As-Maintained

## Why it matters?

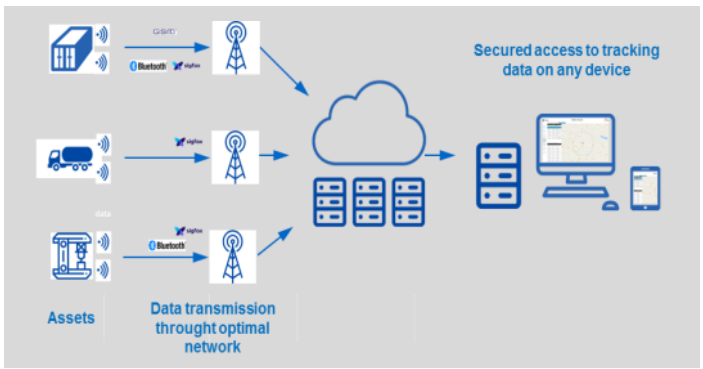
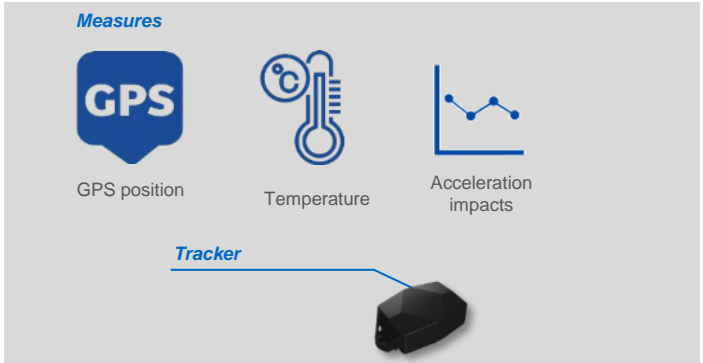
- Reuse of Data & No Duplication
- Flexibility & Separation of concerns
- Configured data availability
- E2E Product Traceability & Conformity
- E2E Digital continuity



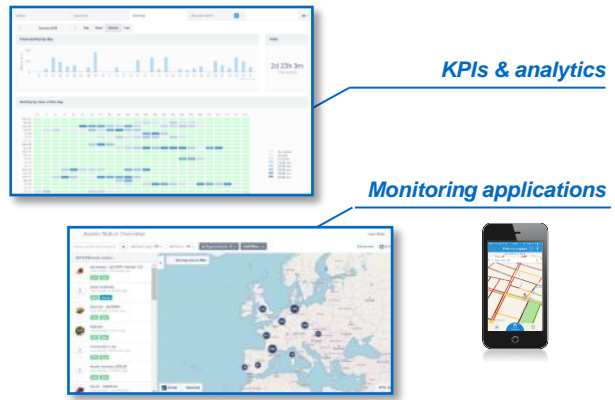


# SUPPLY CHAIN MONITORING FOR OPERATIONAL PERFORMANCE

## Method



## Applications



## Why it matters?

- Supervise end to end supply chain flows
- Reduce work in progress
- Ensure product safety
- Optimize containers fleets
- Measure end-to-end lead times

## Connected & geolocated containers



# DECISION MAKING & SUPERVISION

## Ariane 6 End-to-End production supervision

- Overview of A6 overall production (from Suppliers to Launchpad)
- Quality monitoring

## Production flow real time monitoring

- Support of Production routines
- Work Orders monitoring, On time delivery, Allocated/Spent time
- Alert support function in case of « issues » → ANDON

## Production, Machine and infra. monitoring

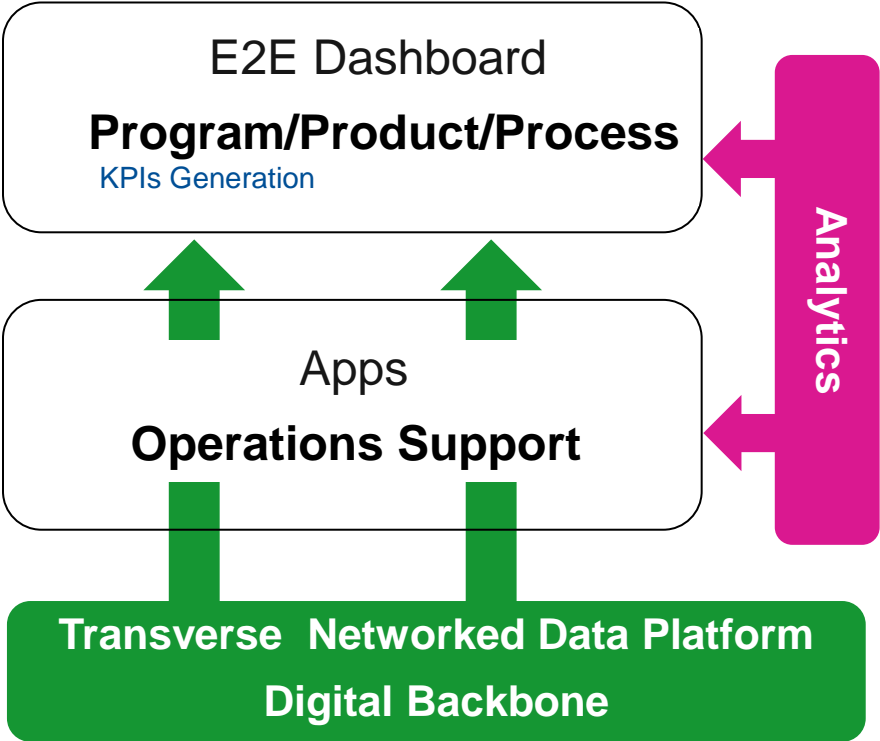
- On-line Real-time Monitoring & Statistical Process Control (SPC)
- Production means status

## Logistics real time monitoring

- Availability of tools, parts and materials



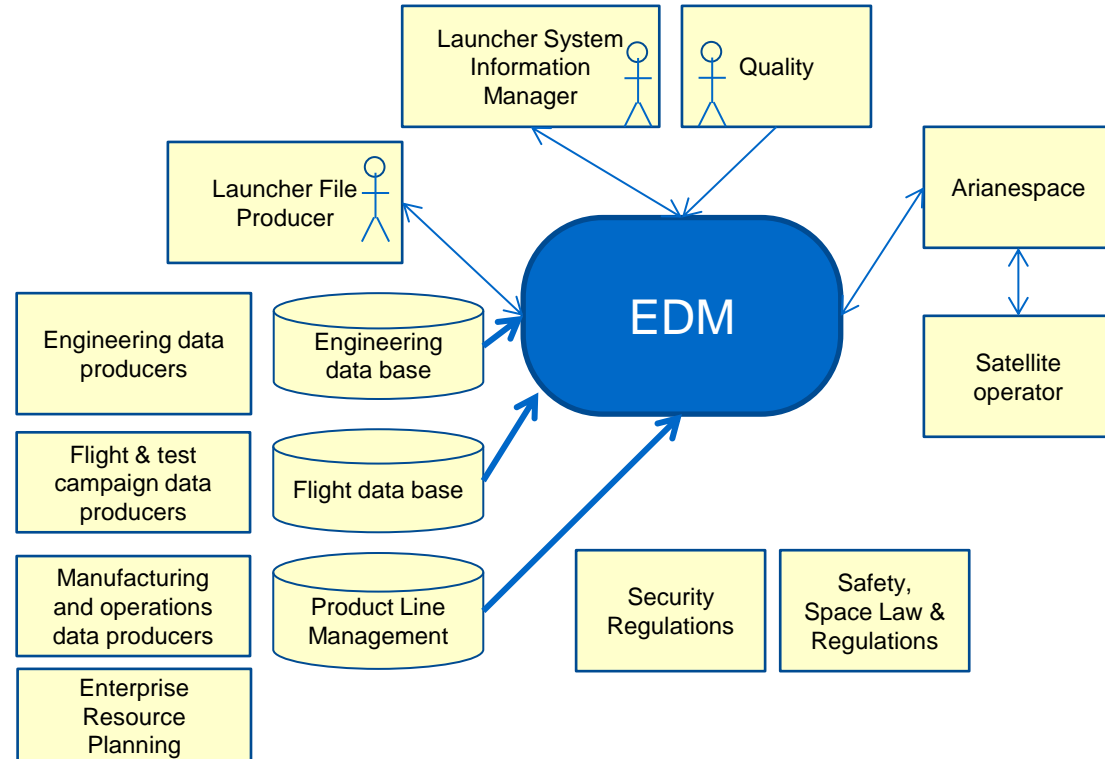
- Shop floor large screens
- Team leader computers
- Smartphones



# EXPLOITATION DATA MANAGEMENT (EDM) CHALLENGES

## Challenges in Extended Enterprise environment:

- To get engineering data and recorded test **data from partners**
- To **share** definition and production data (both ways)
- To have **gateways to transform data** for inclusion in a Central Data Management system,
- To properly manage the **configuration** at all levels
- To **give access** to consolidated data / **dashboards**,
- To jointly exploit data for **improvement**
- To insure **integrity and security** of the Data Management System



\* Launcher File → to demonstrate flight worthiness

# CONCLUSION

## Digital Continuity is now a reality → an opportunity

- At the FOC, the full end-to-end digitization should enable a fast exploitation of a large amount of data.
- it will be possible to monitor in real time the status of the launcher before it is launch without delay, and with high confidence,

## Exchanging and sharing data with the partners are a big challenge

- Technically : exchange formats, tools compatibility, amount of data
- Intellectual property and contractual issues have to be solved
- Security : several type of risks have to be managed to insure data integrity, data protection and service continuity

## Developing a fully connected Exploitation Data Management system needs investments

# DIGITAL TRANSFORMATION ENABLES ARIANE 6 INDUSTRIAL PERFORMANCE

## Leverage on a Design & Production Digital Backbone

- Consistent PLM/MES/ERP enabling Digital Continuity
- Collaboration through Extended Enterprise portals
- Data Governance

## Efficient human centered & connected production system

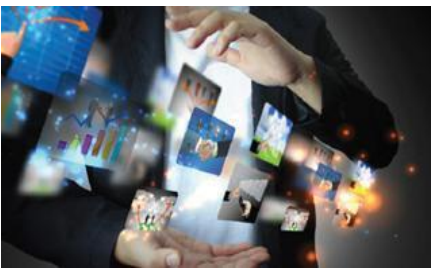
- Helping teams & managers for continuous improvements
- Dashboarding & Supervision for fast decision making

## Interoperability of HW & SW components on top of the digital backbone

- Reuse of standard solutions
- Adaptation to local needs

## Cyber Safety at components and system level

## Cultural Change Management as vector of success



Design & Production system fully connected

Human centered Factory



Cyber-safe infra-structure

## Industrial Pillars

**RC**  
**Lead time**



Reducing non value added tasks

**Right first time**



**Zero defect**



Maximum reliability

**Flexibility**



Quick & efficient decision