

Usages et apport des Digital Twins chez AIRBUS

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Digital Twins : usages, technologies et apports pour la supervision et la conduite de systèmes physiques, 16 octobre 2026

VALUE CREATION

The Benefits for Airbus GROUP

Business Benefits

Accelerated Development
Faster time-to-market via digital simulation.

Elevated Safety & Quality
Proactive deviation detection & predictive maintenance.

Operational Efficiency
Extended component life & reduced downtime.

Environmental Performance
Reduced physical waste & optimized decarbonization.

New Business Opportunities
Digital Twin as a Service across the ecosystem.

IT & AI Benefits

AI Training Environment
Risk-free virtual learning environment for AI models.

Physics-Informed ML
Merging theoretical physics with real sensor data.

Continuous Evolution
Enriched synthetic data generation for algorithms.

Airbus Commercial Aircraft: We Build Twice — Building first in digital, then physical to anticipate failures and optimize value.

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AIRBUS DIGITAL TWINS

Digital Twins at Airbus: Predictive & Prescriptive Intelligence

AIRFRAME

Airframe Digital Twin

MSN-Specific 3D Mirror & Maintenance

- **Single 3D Access Point:** Map tied to MSN numbers across production.
- **Delivery Efficiency:** Real-time inspection saving hours per aircraft.
- **Digital Repair Loop:** Automated stress assessments & paperless repair.

KEY IMPACT

40,000+ 3D Cases Capitalized | Hours Saved per Delivery

MANUFACTURING

Line Balancing Simulator

3D Flow & Shopfloor Intelligence

- **3D PPR Environment:** Time-based simulation with virtual workers.
- **Operational Analytics:** Clash detection and occupancy heatmaps.
- **Scenario Continuity:** Critical path validation before physical assembly.

KEY IMPACT

De-risks 75% of Operational Scenarios

ECOSYSTEM & INFRASTRUCTURE

Supply Chain & Buildings

Resilience & Facility Optimization

- **Predictive Maintenance:** Failure & tool calibration prediction.
- **Supply Chain Resilience:** Disruptions prediction to enhance delivery.
- **Building DTs:** Real-time space & facility maintenance optimization.

KEY IMPACT

+10% On-Time Delivery | +30% Space | -20% Maint. Time

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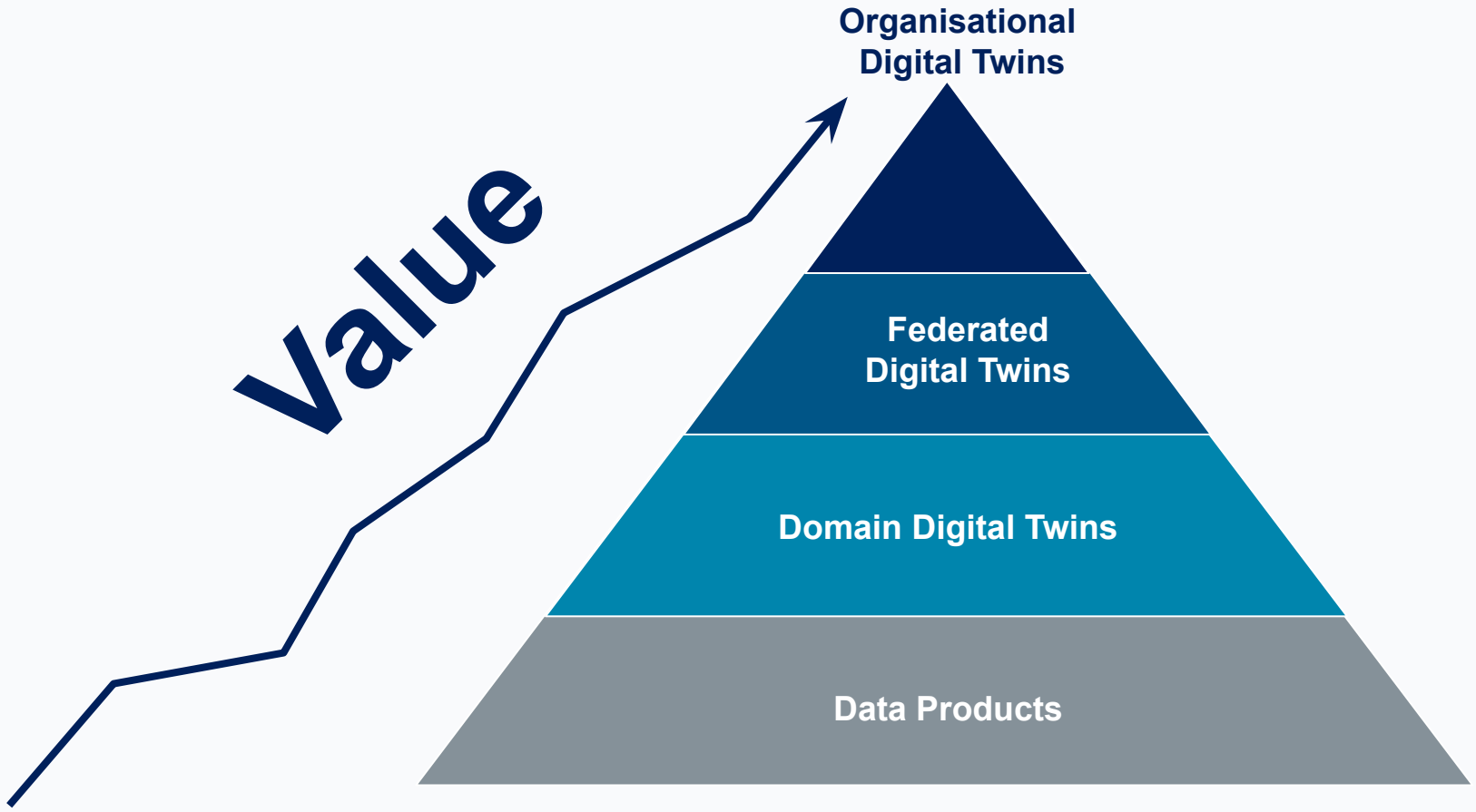
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DIGITAL TWIN JOURNEY

From Data Products to the Industrial Metaverse

From local optimum to **global** optimum

No digital twin without a Digital Thread: An authoritative, unbroken data stream linking engineering design, manufacturing floors, and airline fleets into a single source of truth.





MAKE DATA

- AVAILABLE
- MEANINGFUL
- USEFUL
- VALUABLE

Via the digital thread

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ACADEMIC RESEARCH FRAMEWORK

The 3 Main Challenges of Digital Twin Application

SYSTEM & DATA INFRASTRUCTURE

Technical

- **Standardization:** Aligning legacy protocols & systems
- **Interoperability:** Merging isolated data formats
- **Data Quality:** Reliable raw sensor extraction
- **Security & IP:** Protection & GDPR compliance
- **UX & Talent:** Intuitive UI & skilled developers

PEOPLE & ENTERPRISE CULTURE

Organizational

- **Investment Costs:** Justifying CapEx & OpEx ROI
- **Expectations:** Managing buzzword inflation
- **Change Mgmt:** Overcoming skepticism & fear
- **Data Culture:** Data-driven vs. gut-feeling
- **Regulation:** Aerospace certification rules

FRAMEWORKS & ROI VALUATION

Methodological

- **Clear KPIs:** Defining measurable outcome goals
- **ROI Valuation:** Measuring qualitative benefits
- **Efficient Models:** Optimal fidelity without waste
- **Targeted Pilots:** Quick-win demonstrators
- **Net Audits:** Post-implementation validation

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SIMOPS APPROACH

Towards Digital Twins: The 4-Step Framework

ANTICIPATE | Design | Operate | LEARN

01

Data Referential

Standard ontologies, geometry referential, and decoupled data products.

02

Simulations

Behavioral physics, virtual commissioning, robot testing, and flow optimization.

03

Data Integration

Real-time IoT/MES telemetry, connected aircraft, and matching physical data to models.



04

AI Operations

Multi-agent AI support, predictive actions, and closed-loop optimization.

AI AS BOOSTER

Sim2Real Continuous Feedback Loop

Sim2Real ⇄ Real2Sim ⇄ Sim2Real — Continuous model calibration and optimization

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Cas d’application

Digital Twin dans l’industrie spatiale

Opérations

Planification mission
Puis-je allumer des instruments non prévus initialement ?

Satellite d’observation
Quelle est sa durée de vie estimée à l’instant t ?

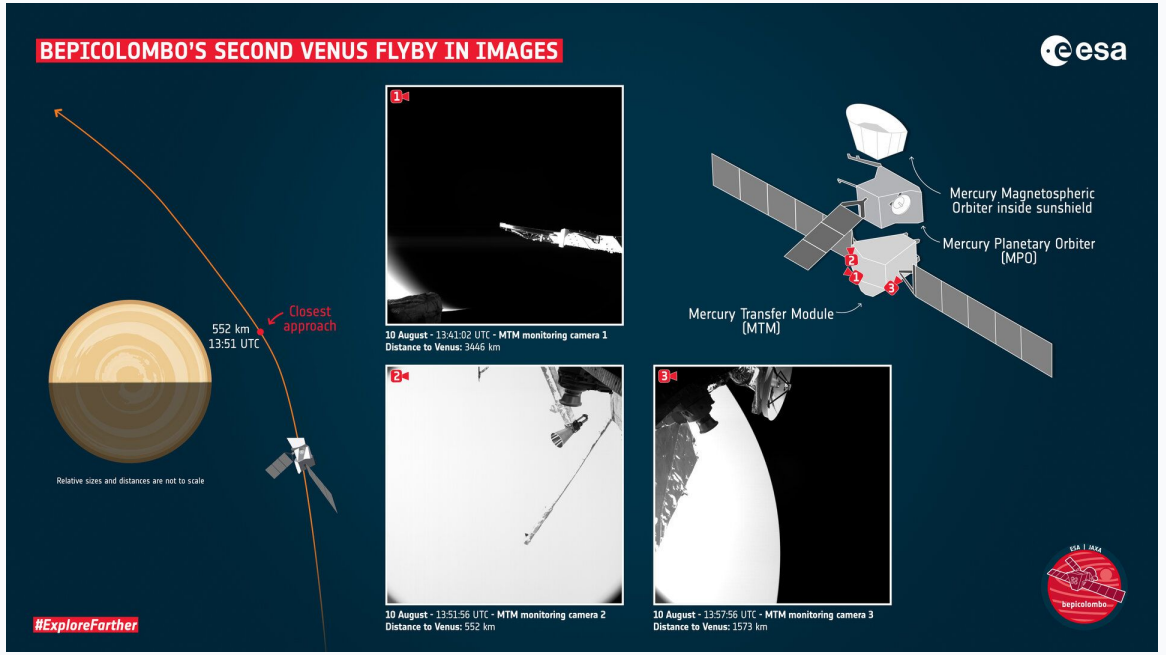
Satellite de télécommunication
Quelle enveloppe mission est accessible à l’instant t ?

Ingénierie

Capitalisation d'expérience
Bénéficier de l’expérience des programmes antérieurs en phase amont ?

AIT

Calibration automatique des modèles comportementaux ?
Virtual hybrid testing avancé ?
Système de production ?



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SOCLE TECHNOLOGIQUE

Digital Twin - Technologies clefs

01

Données

Accès aux données
Qualité des données
Données réelles / données simulées

02

Modèles

Caractérisation
Gestion des modèles comportementaux et statiques
Gestion de configuration

03

Recalibration

Recalibration assistée ou automatique

04

Simulation distribuée

Framework de simulation distribuée
Interopérabilité

05

Configuration

Configuration d'une simulation en fonction des objectifs

06

Multidisciplinary Design Analysis and Optimization

Modèles connexes ou communs
MDAO au service du Digital Twin

07

Opérations

Connaissance des marges
Simulations What if
Performances

08

Digital Twin étendu

Système spatial
Système sol
Charge utile / plateforme
Equipements
Digital d'environnement spatial

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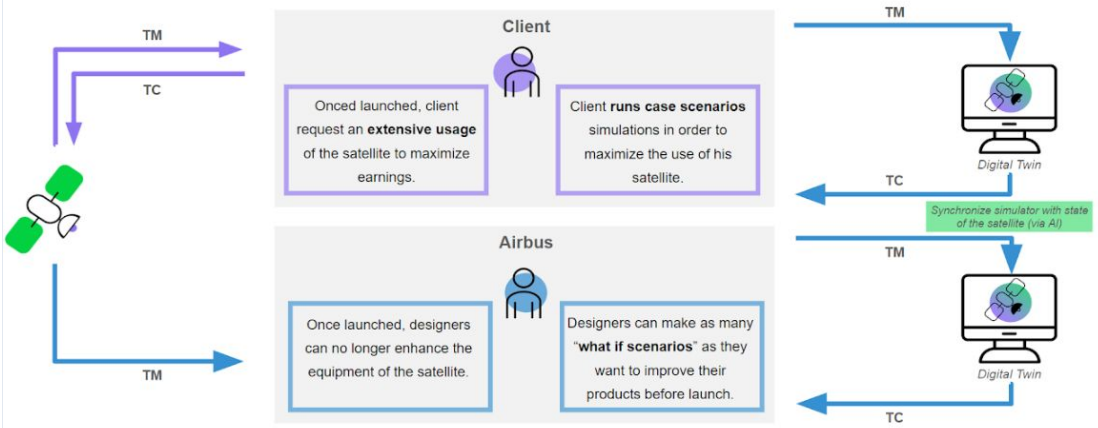
RECHERCHE & PARTENARIATS

Projets Recherche

PARTENARIAT IRT

IRT Saint Exupéry

Methodologie de recalibration automatique
IRT St Exupéry 2021-2024
Partenaires : Airbus Defence and Space, Thales Alenia Space



AGENCE SPATIALE

ESA

GSTP Pilot Digital Twin S/C for operations and AIT

TRL 3 à 7

Développement d'un Produit Minimum Viable

Phase 1 : architecture, sémantique, approche de modélisation, agrégation de données, ergonomie

Phase 2 : projet pilote et validation

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Airbus Digital Twins Maturity Evolution Journey

ACE
Airbus Concurrent Engineering
1995-2005

DDMS
Digital Design Manufacturing & Services
2019 - ongoing

Value

	A320/A321	A330/A340	A380	A400M/A350	A321XLR	Next-Gen Programmes
	Standalone	Descriptive	Diagnostic Twins	Predictive Twins	Prescriptive Twins	Autonomous Twins
						
Focus	Physical prototypes	Basic digital model	Past & current operational analysis	Predictive behavior forecasting	Optimal action suggestions	Self-regulating systems
Capabilities	Disconnected 2D models Limited compute & storage	3D static visualization Basic PDM systems	BoM & sensor integration Early PLM systems Multi-discipline workflows	Advanced analytics Failure & performance simulation Cloud, IoT & Big Data	AI recommendations MBSE & What-If analysis	Continuous AI/ML optimization AI Agents Integrated ecosystem
Purpose	Iterative physical testing	Foundation for advanced twins	Manufacturing insights & issue resolution	Proactive scenario planning	Optimized cross-system efficiency	Autonomy with human oversight
	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
	1980s	1990s	2000s	2010s	2020s	2030s

Digital Twins Maturity Level / Level of Effort

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