Innovation Opportunities and Challenges
- Digital Twin Taking Flight
- AERALIS case study

Simon Skinner, Thales Training & Simulation
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ETSA ITSEC Innovation Special Event

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Introduction to Digital twins


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Why you may have a thinking digital twin within a decade

By Jane Wakefield
Technology reporter

13 June

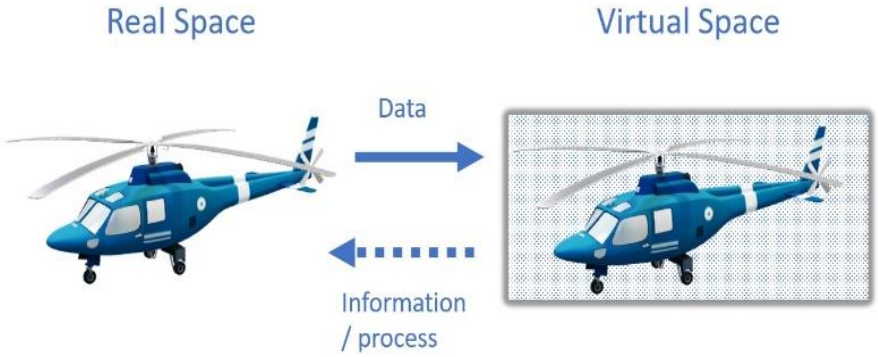
GETTY IMAGES

Some experts say that 'thinking digital twins' of humans may be just a decade away

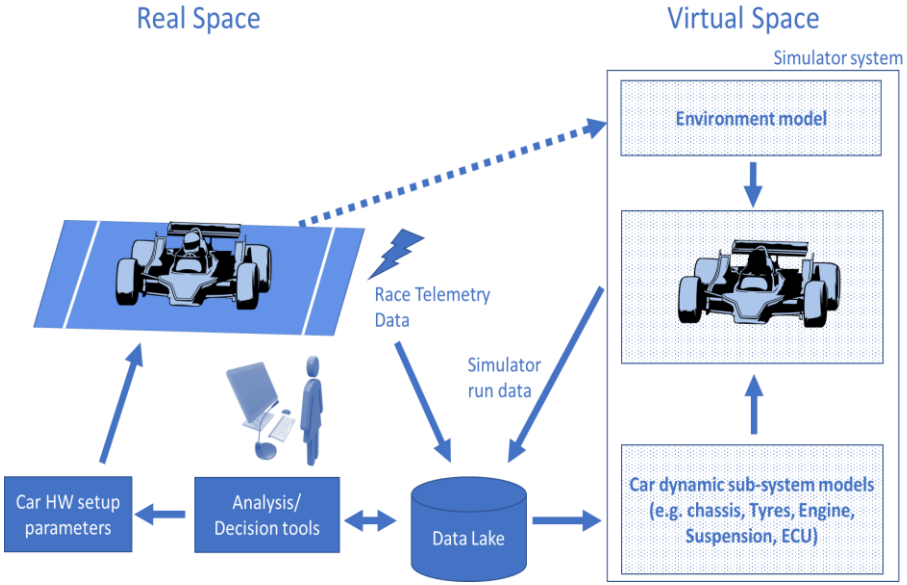
Definitions are important

'A Digital Twin is a virtual representation of a connected physical asset'

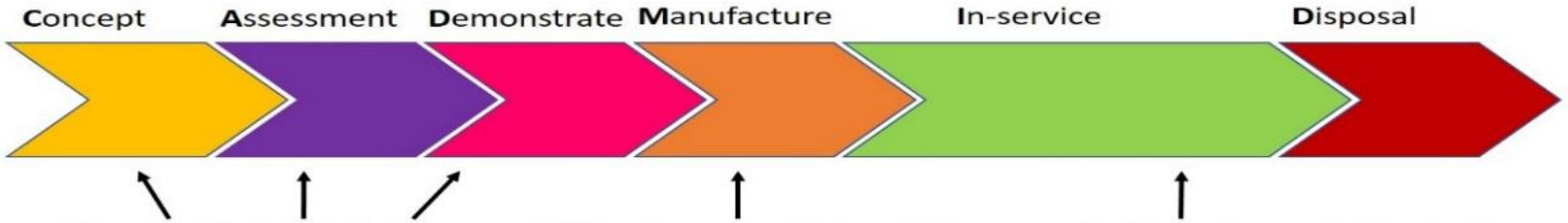
Other definitions exist…



Digital Twins are not new



Digital Twin use cases in the military context



CADMID CYCLE FOR MILITARY SYSTEMS

Initial Model | Refined Model | Approved design | Manufactured item | Concept changes

Digital Thread of Data

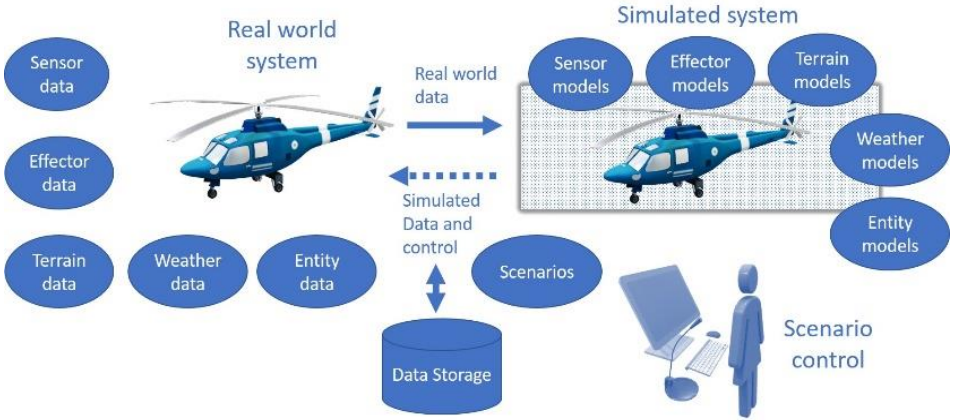
DT for design testing | DT for Prototype manufacture | DT for qualification | DT for mass manufacture | DT for performance analysis | DT for predictive maintenance | DT for Training

Example – Platform design, manufacture & test using Digital Twins

Navantia F110 Frigate, 1st to be designed and built using Digital Twins

AERALIS modular aircraft system – digitally engineered from the start

Digital Evaluation and Test Range



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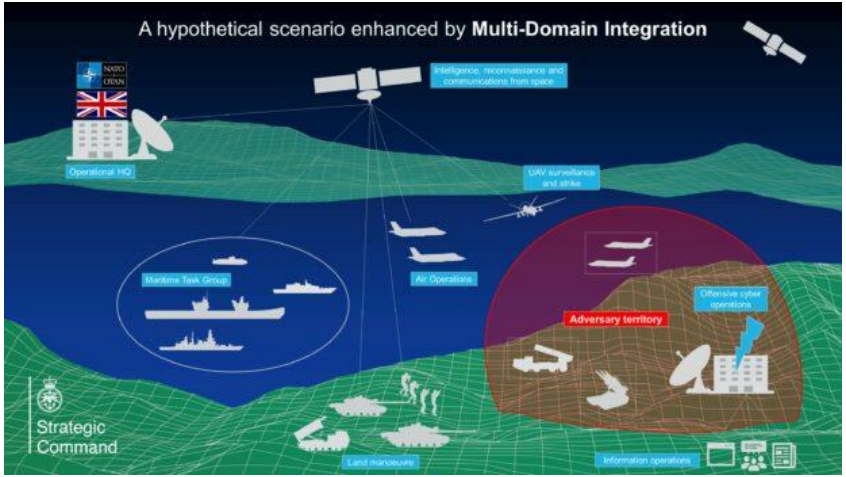
Building a future we can all trust

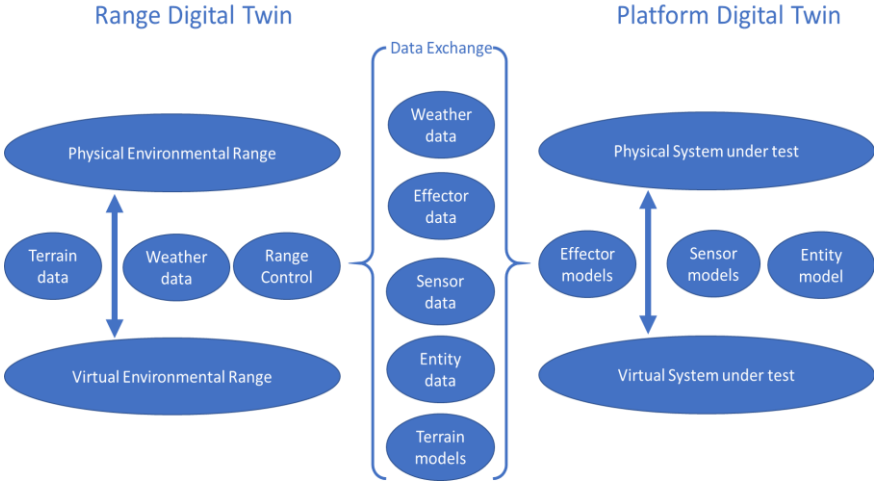
Digital Twins have to be interoperable…

Multi-Domain Integration (MDI)

- Defence does not operate in silos
- Platforms and systems interoperate both inside and outside countries
- 'System of Systems' approach



Digital Twin based test range connected for 'plug and play' testing and certification activities



..But it's not simple

- Intellectual Property and Ownership
- Dynamic nature of Digital Twins
- Data standards and interoperability
- Security Standards
- Fidelity and abstraction

NATO OTAN S&T organization

Task group 205

NB. Participant nations & companies correct as of 4/10/22

MBDA Navantia QINETIQ THALES Building a future we can all trust LEONARDO SDT

Open architectures and a standards based approach is important, NATO task group started in October 22 to solve these issues

A Digital Twin Approach:

- Who / What is AERALIS – The Platform
- Thales AircrewNext – The Human
- Core AERALIS Platform and Environment Simulation (CAPES) – The Digital Twin

THE FUTURE OF AIR FORCE FLEETS

BUY ONCE AND ADAPT

85%

COMMONALITY

'NAVAL'

AGGRESSOR

NAVAL VARIANTS

'UNCREWED'

UNCREWED ISTAR

UNCREWED TANKER

>50%

THROUGH-LIFE COST REDUCTION

AERALIS

'TRAINER'

BASIC TRAINER

AJT / LIFT

AEROBATIC TEAM

SAME
Common Core
Fuselage

'COMBAT'

OPERATIONAL VARIANTS

UNCREWED WINGMAN

A SUSTAINABLE PATH TO NET ZERO

DIGITAL DESIGN

DIGITAL TEST FIRST

NEW MANUFACTURE

TRAIN WITH SYNTHETICS

RECONFIGURE NOT REPLACE

ADOPT NEW TECH

RECYCLABLE & BIODEGRADABLE

PROCUREMENT

CERTIFICATION

SUPPORT

MAINTENANCE

TRAINING

SINGLE DIGITAL TRUTH: AERSIDE™

Innovation
Exploitation
Digital Twin / MBSE

AircrewNext

Next generation air crew training
for the future of air operations

The Individual
Learning Journey

Collective
Competence

Data Analytics
with Digital Trust

Trusted
Artificial Intelligence

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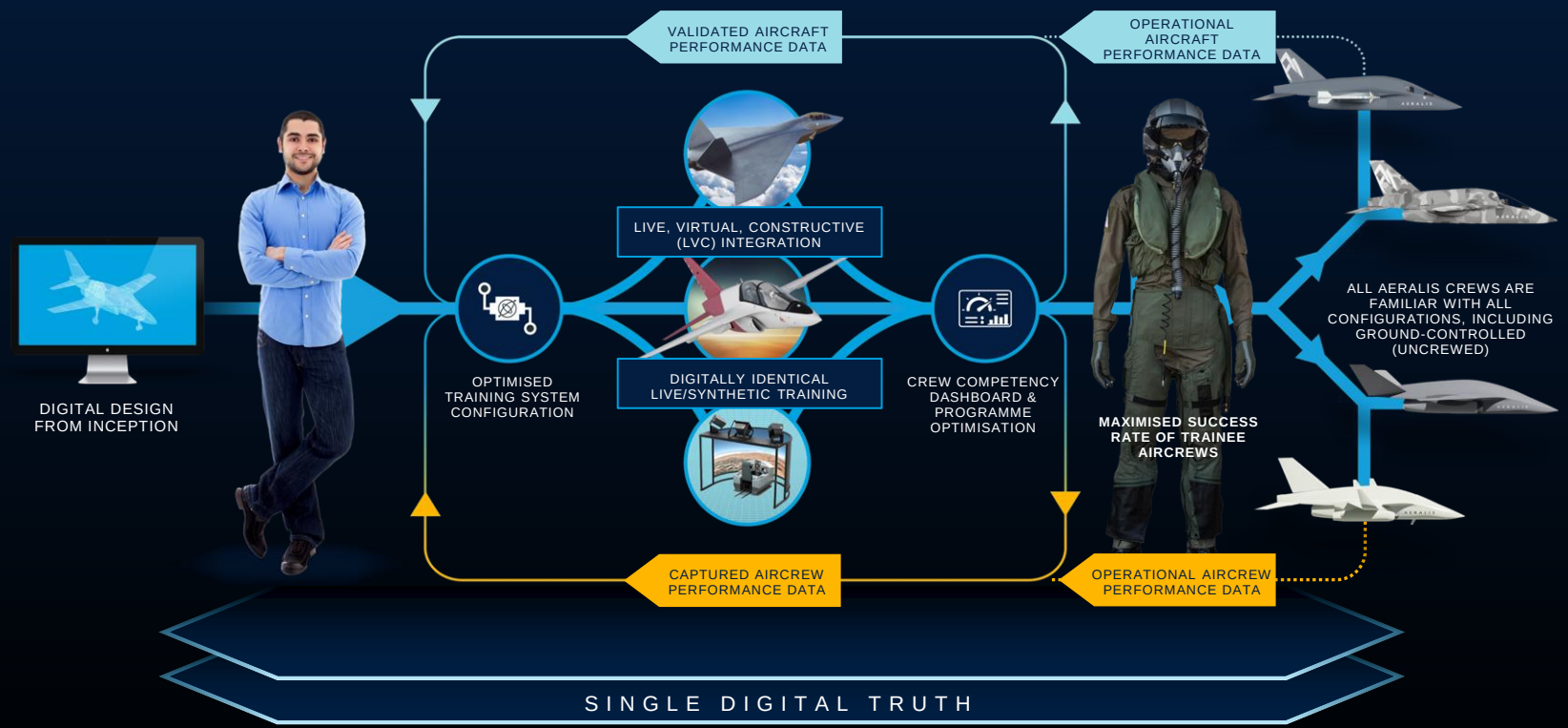
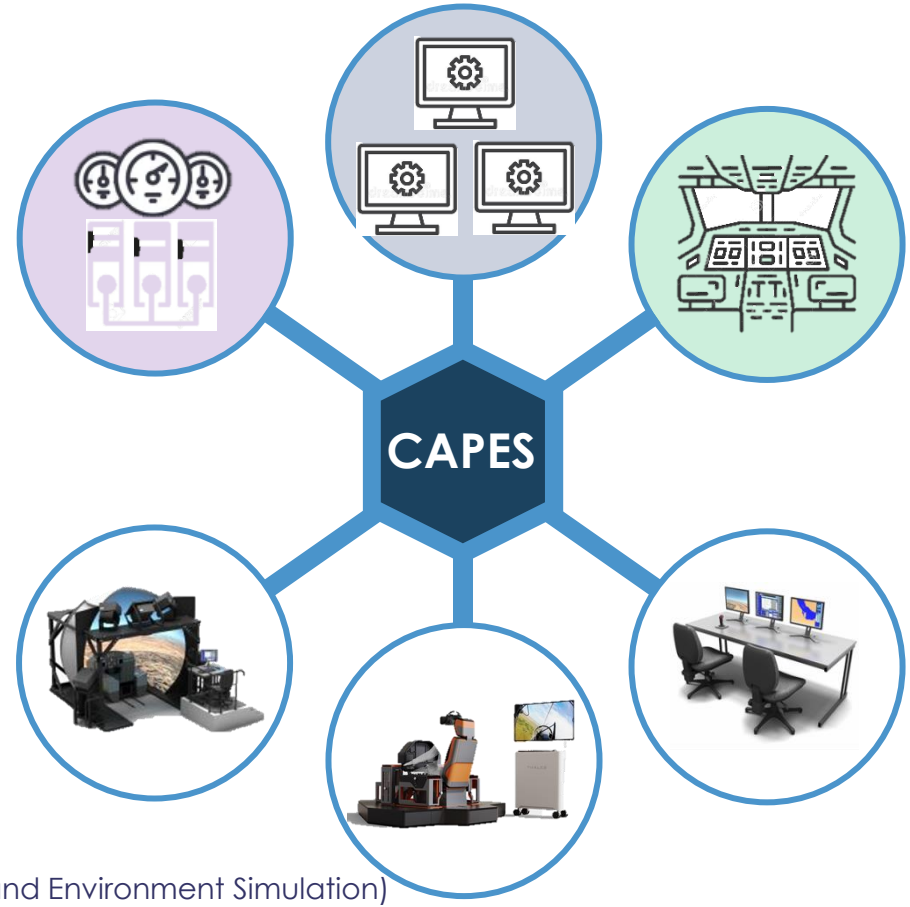
A DATA-DRIVEN REVOLUTION IN TRAINING

AERALIS



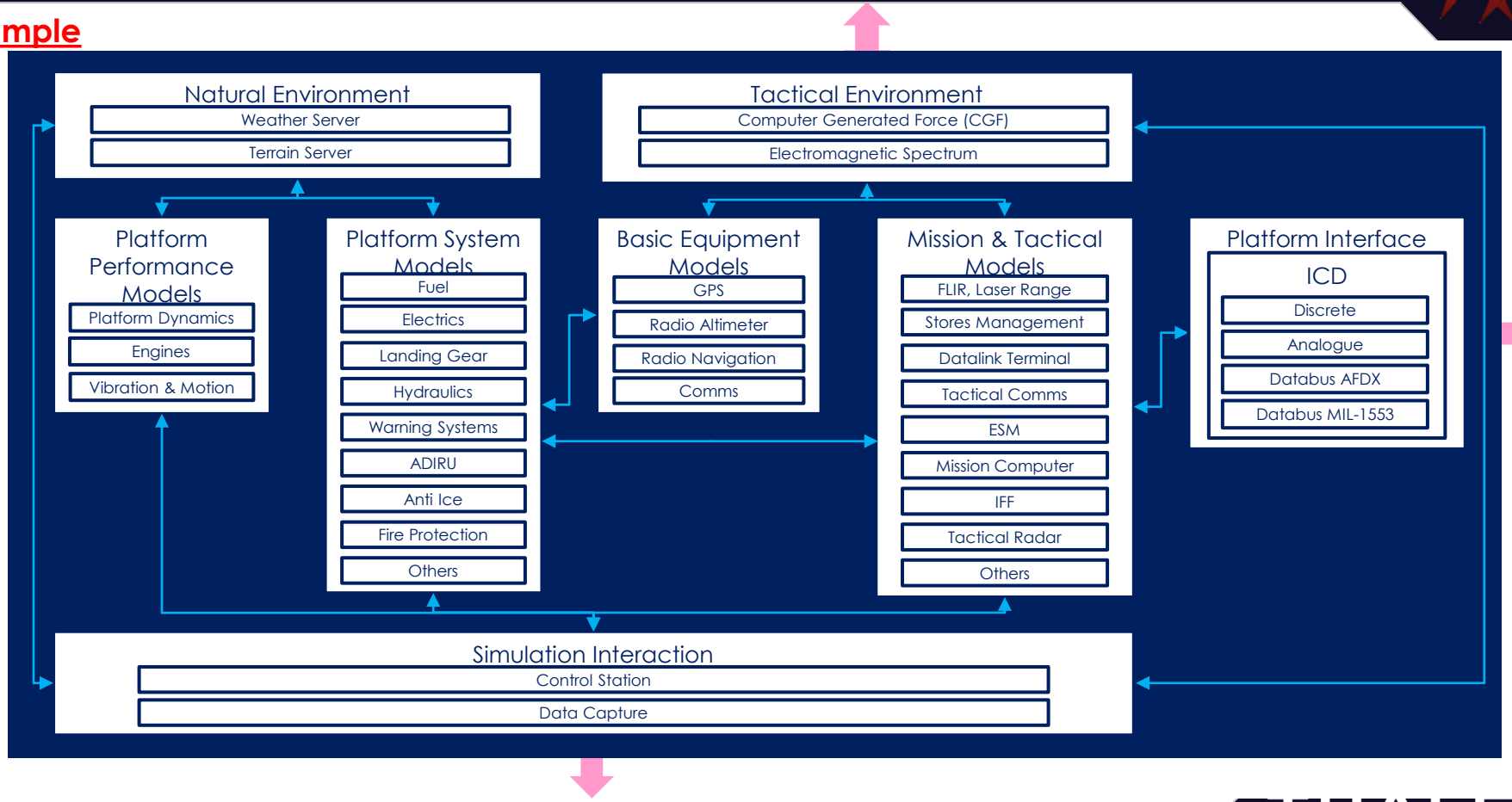
CAPES – Core to Digital Twin and Training Devices



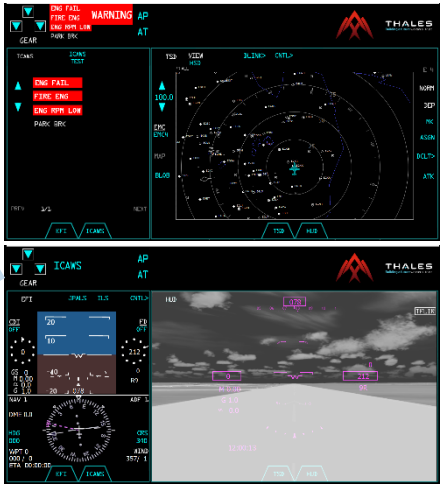
*CAPES (Core AERALIS Platform and Environment Simulation)

Core AERALIS Platform and Environment Simulation (CAPES)

Example



So far- Augmented Reality Cockpit



OTW Image

LAD Image / Touch

USB Controls

Out The Window View

CIGI data

AERALIS Flight Model

CIGI data

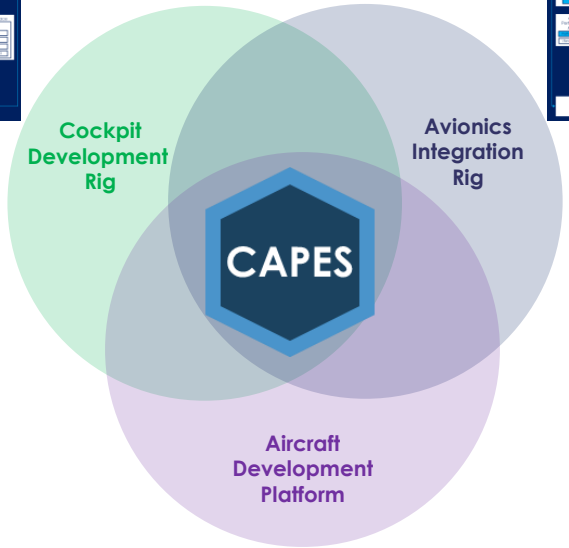
Large Area Display (LAD) Mockup

CAPES Rig Relationship

- CAPES is the central element which can be drawn upon by each of the rigs, and in the future will form the basis for any type of training device
- As models get integrated into CAPES, it can be physically deployed to each of the development rig as an update.
- The composition of CAPES can vary dependant on the rigs requirement for hardware in the loop and elements that either need to be stimulated or emulated
- This composition principle is the same for future training devices. Forming the basis of a Training Ecosystem.

CAPES Composition A

CAPES Composition B



An Instantiation of the CADMID Cycle

CAPES Composition C

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CAPES in use

Example

Image Generator

- AERALIS 3D CAD Model
- Out The Window View
- Thales Weather
- Thales Terrain

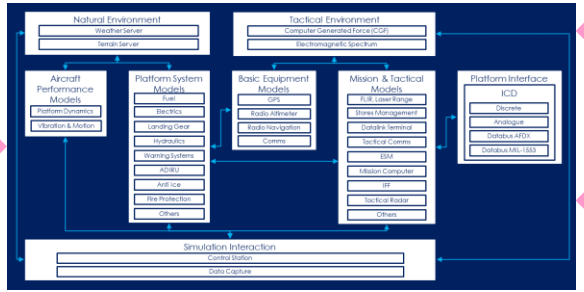
Image

Scenario Control

Platform Control

Platform Simulation

Data Capture



Sim Controls

USB

Virtual Bus Interface

Image / Touch

Avionics Re-host

Physical Interface

- A429
- Discrete
- CAN

Physical Aircraft Large Area Display (LAD)

CAPES capability develops over development cycles of Aircraft Systems

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Conclusions

- **The use of modelling and simulation for applications other than training is growing fast to support the Multi-Domain Integrated approach**
  - Operational analysis
  - Decision support
  - Flexible force training and deployment
  - Mission preparation
- **New platforms (e.g. AERALIS) built with data driven digital Threads form part of this framework of this new approach**
  - Higher performance, more flexible and reliable platforms
  - Faster to certify, manufacture and deploy
  - Reduced through life environmental impact and cost
  - More effective interoperable systems for the Multi Domain Integrated approach

Follow Up

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