

Taking simulation interoperability to the next level with Digital Twins



Simon Skinner
October 2022
NMSG Symposium – MSG197

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Why you may have a thinking digital twin within a decade

By Jane Wakefield
Technology reporter

13 June

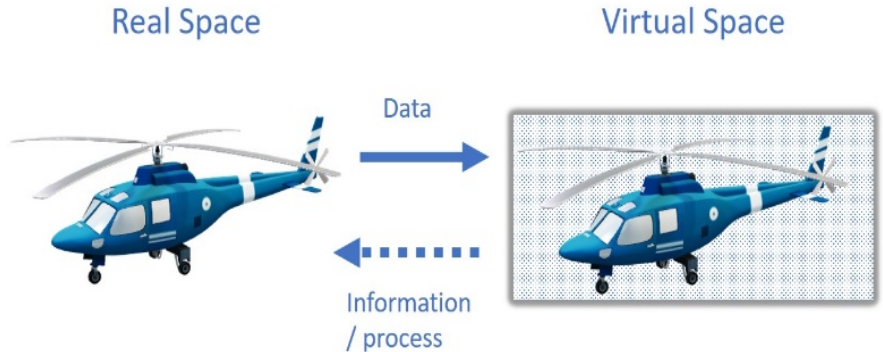


Some experts say that thinking digital twins of humans may be just a decade away

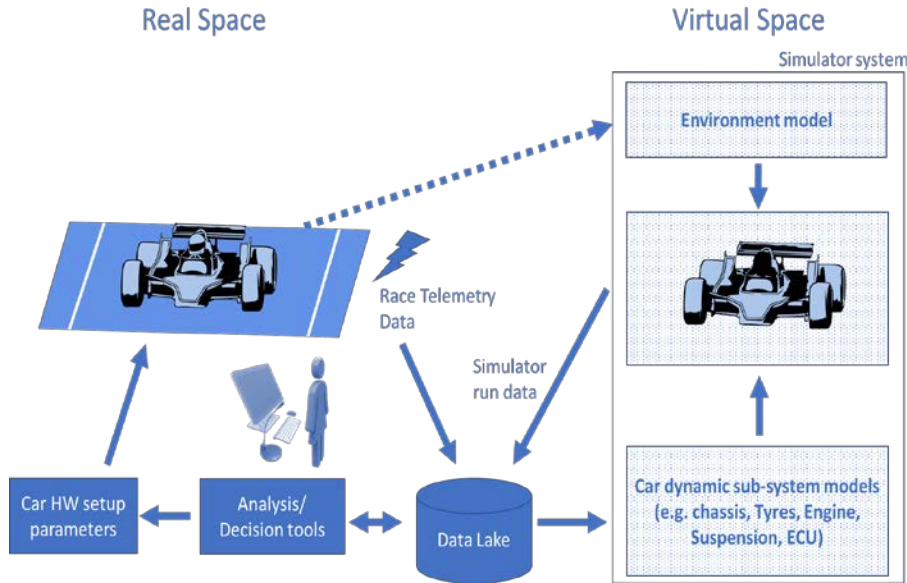
Definitions are important in the NATO context:

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

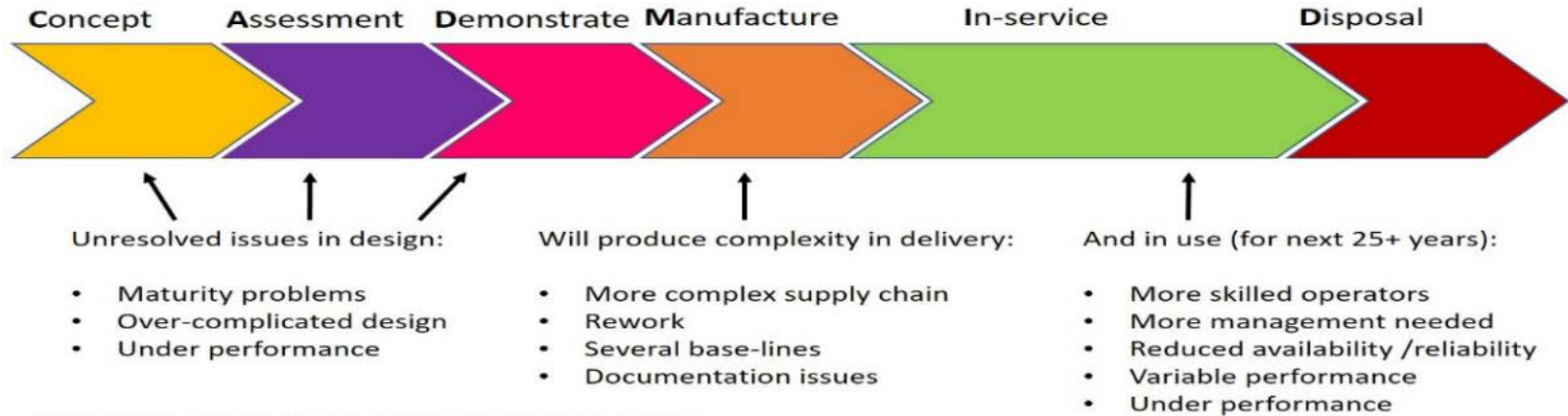
Other definitions exist...



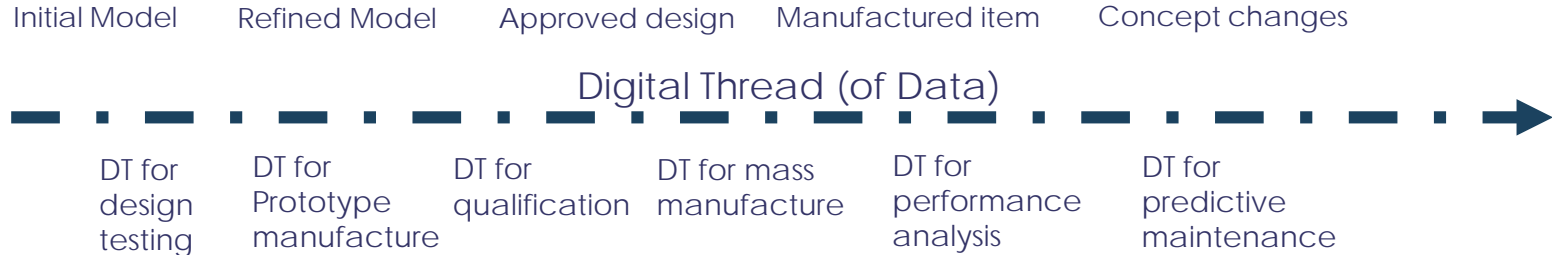
Digital Twins are not new



Digital Twin use cases in the military context



CADMID CYCLE FOR MILITARY SYSTEMS



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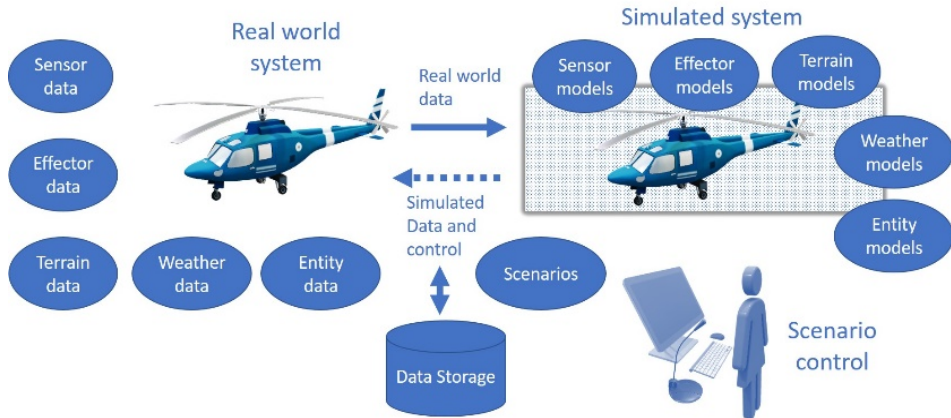
Example – Platform design & test using Digital Twins



By KT-DES - Own work, CC BY-SA 4.0,
<https://commons.wikimedia.org/w/index.php?curid=114393620>

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

Digital Evaluation and Test Range



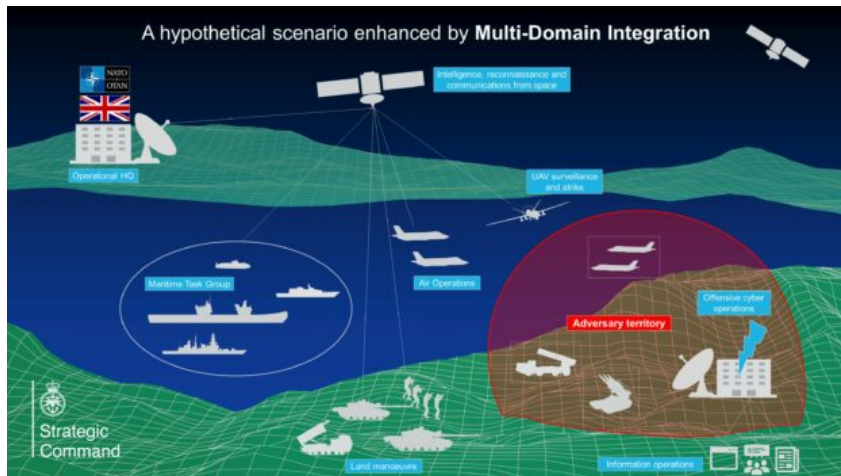
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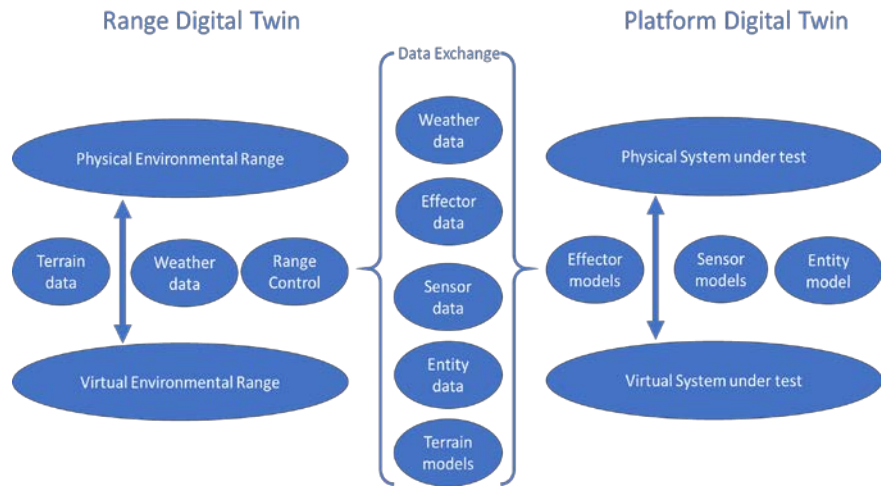
Digital Twins have to be interoperable...

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 connected for 'plug and play' with data exchange



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..But it's not simple

■ Intellectual Property and Ownership



■ Dynamic nature of Digital Twins



■ Data standards and interoperability



■ Security Standards



■ Fidelity and abstraction



Reuse work from other NATO research teams to help solve these issues

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Exploratory Team ET-053 activity

NATO Nations



NATO Organisations



Partnership For Peace



Partners Across The Globe



Statistics:

- 9 meetings between December 2021 (ITSEC) and March 2022
- 32 members taking part on science connect
- 4 industry and academia presentations
- 4 Key questions
- 1 Biggest point of contention: Definition of a Digital Twin
- Team output: 1 revised Technical Activity Proposal (TAP)
- Briefings of exploratory team activity at IT2EC (*2) and SISO SIW

Next steps – Research Task Group MSG-205

- 1 - What is the **definition** of a Digital Twin that will be used in this group and others within and outside NMSG?
- 2 – How can we effectively **exchange** information (such as mathematical models, simulations, equipment and environmental data) between Digital Twins operating in different nations?
- 3 – How can we ensure the **security** of information exchange and operation of a Digital Twin against adversarial penetration and attack in distributed networks and diverse computing and storage resources ?
- 4 – How can we ensure **coherency** in analysis, storage and discovery of the large quantities of data ingested and generated by operating Digital Twins in the NATO context ?



NORTH ATLANTIC TREATY ORGANIZATION
SCIENCE & TECHNOLOGY ORGANIZATION



ACTIVITY SUMMARY			
Panel/Group	MSG	Activity Title	
Reference Number	MSG-205	Allied Interoperability and Standardization Initiatives for Digital Twins	
Activity Type	Task Group		
Panel Approval Date	Board Approval Date	Activity Start Date	Activity End Date
13 May 2022	20 Jul 2022	01 Sep 2022	01 Sep 2025
Related Activity	MSG-164, MSG-145, MSG-193		
Projected Meeting Location(s)	Virtual		
Lead Nation(s)	United Kingdom, Italy		
Team Leader(s)	Mr Simon SKINNER (GBR) Dr Luigi CAPONE (ITA)		
Panel/Group Mentor	FATEL Bharatkumar (M)		
NATO Nations/Orgs Invited to Participate	NATO Bodas		
Non-NATO Nations/Orgs Invited to Participate	STO/SDP OPB GP		
Nations/Orgs Committed to Participate	DOD ESP ESP TUR SBA USA ACT		
Nations/orgs Interested in The Activity	AUT GBR GYR EST FRA ALD POL CHN NEAD		
Nations Actually Participating	FRA CHN ITA ESP TUR GBR ACT		
Security Classification Level or the Ac...	Releasable to the Public		
Keywords:	Acquisition, Architecture, Artificial Intelligence, Big Data, Cloud Computing, Cybersecurity, Data Lake, Digital Twin, Experimentation, Interoperability, MISE, Modelling, Simulation, Standards, Systems Engineering, VVA		
NATO and National Resources Requir...	Standard RTG support I.a.w. STO Collaborative Network OPs		



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



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Draft Programme of work summary (as of 04/10/22)

1. **Defining what a Digital Twin is** for NATO activities providing terminology into the NATO terminology database; **ideally reusing an existing definition** rather than creating something new;
2. **Examining the problems and issues in interoperability terms** of using Digital Twins in the NATO context **identifying technological and standardisation gaps**;
3. **Assessing the various existing simulation standards** for constructing and operating Digital Twins, examine if existing standards **from a variety of standardization organisations** can fill these gaps and if not what developments (technology, standards) might be needed;
4. **Assessing existing government, NATO and commercially available products** and services for Digital Twins to help develop solutions for the gaps;
5. Based on these investigations, **develop experimental potential solutions and a multi-national technical concept demonstrator**;
6. **Assessing current NATO regulations that may affect Digital Twins, generating a set of guidelines / best practices for implementing a Digital Twin in the NATO context**: and work with NATO bodies, standards and other organizations to refine and promulgate the guidelines / best practices;
7. Working with appropriate NATO stakeholders and end-users, **produce a final report** describing the work of the team, achievements and set of recommendations.

- **The use of modelling and simulation for applications other than training is growing fast**
- **Digital Twins form part of the framework of this new approach**
 - Better and more reliable platforms
 - Reduced through life environmental impact
 - More effective systems for the Multi Domain Integrated approach
- **Interoperability of data and models is key**
 - Technical standardisation approach is vital
 - Business approaches to handling IP and data management are important too
 - Common reliable network infrastructure and computing resources are needed
- **MSG205 research task group will work on these challenges**

Questions ?

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