



Application of AI within Data-centric Engineering and Autonomous Systems

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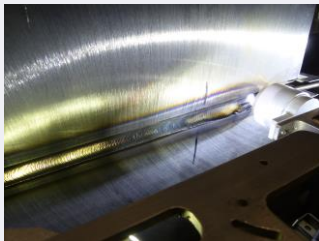
Rolls-Royce

Where are we considering applying AI?

The focus of this presentation

Manufacturing, such as:

- Additional radiography checks
- Live welding data analysis



Verification, such as:

- Adversarial attacks on the C&I
- Analysis of rig data



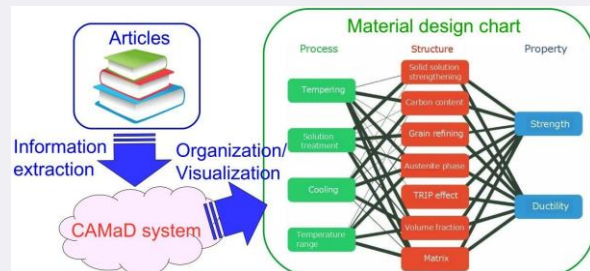
In-Service, such as:

- Equipment Health Management
- **Data-centric Engineering**
- **Future automation**

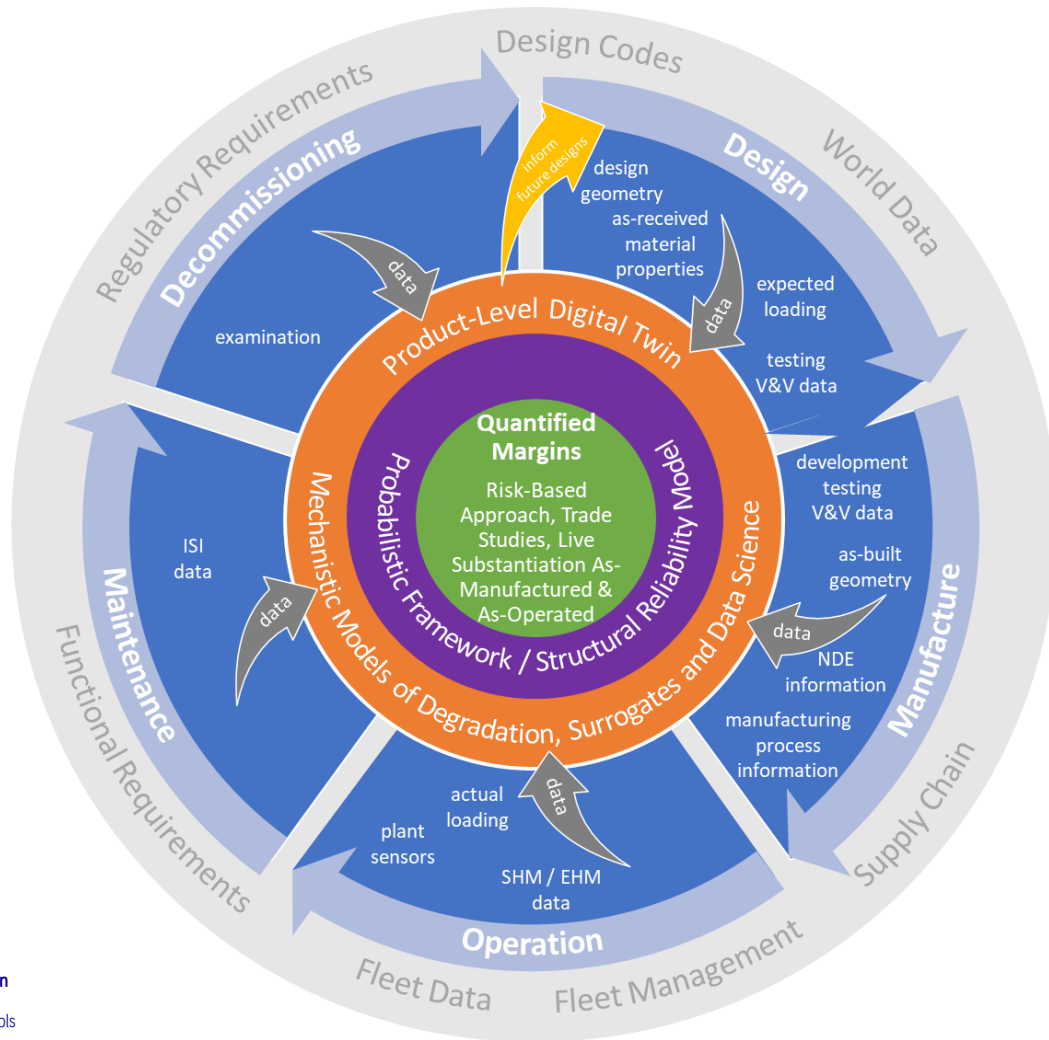


Design, such as:

- Estimation of material properties
- Physics solvers



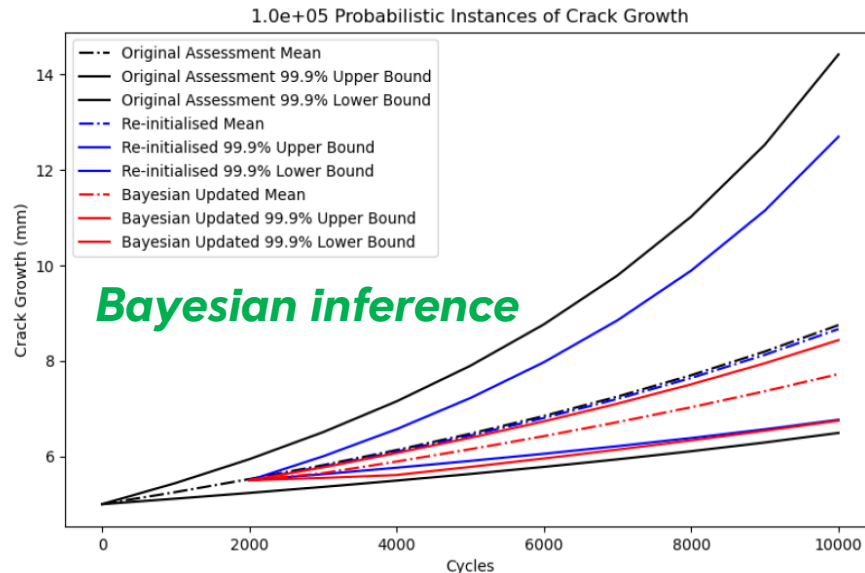
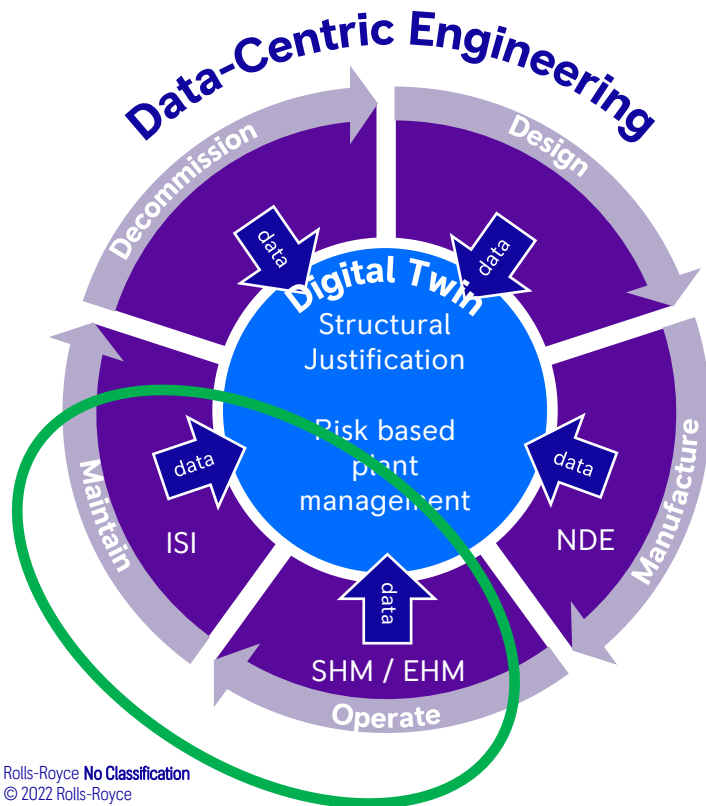
Data-Centric Engineering



V&V Validation and Verification
NDE Non Destructive Examination
SHM Structural Health Monitoring
EHM Equipment Health Monitoring
ISI In-Service Inspection

ISI Data Case Study from EASICS

EASICS Establishing AMR Structural Integrity Codes and Standards for UK Generic Design Assessment
ISI In-Service Inspection

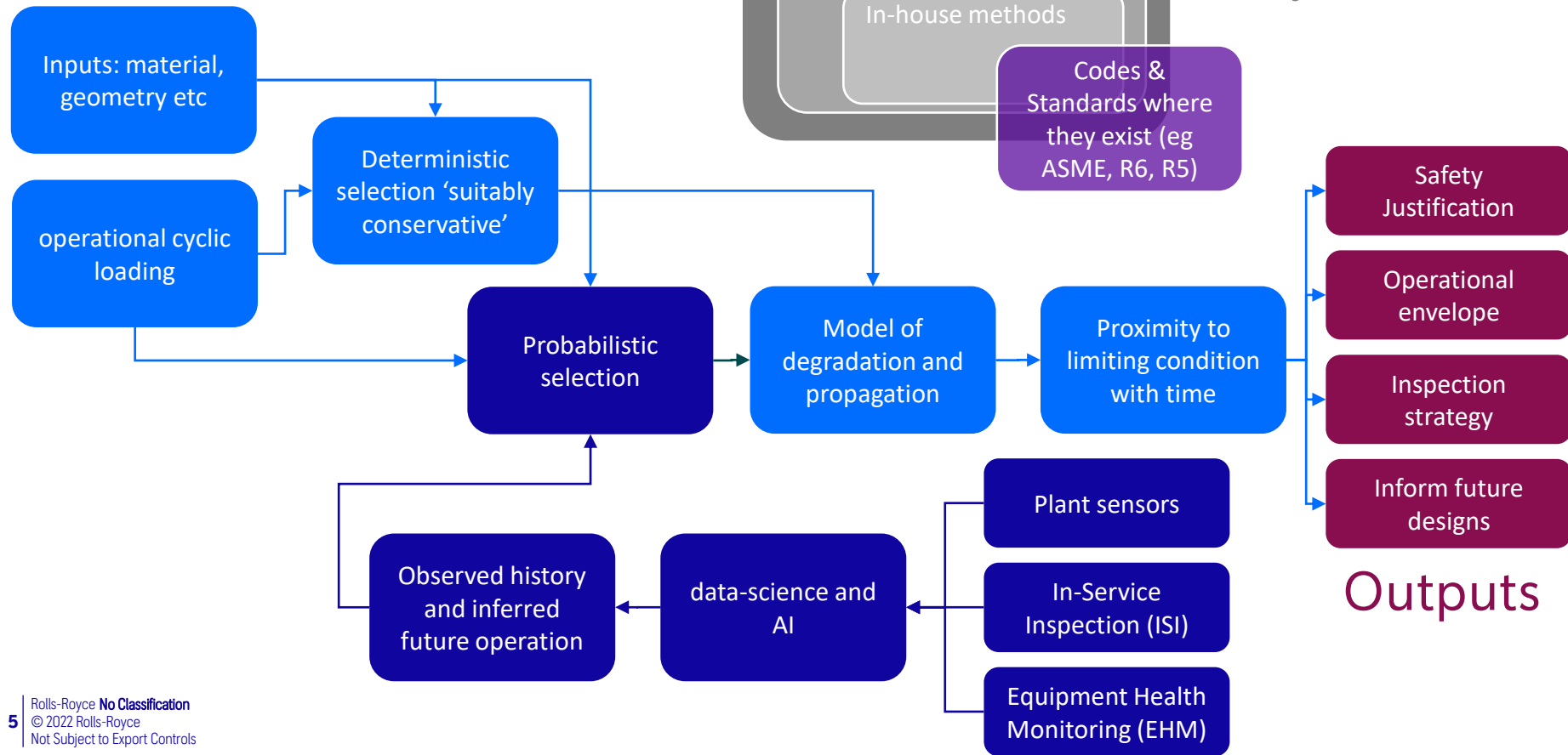


Follow-on study using Markov Chain Monte Carlo and simulated fleet data

M Martin, R Marshall, P Reed, Data-Centric Structural Integrity Assessment and Risk-Informed Asset Management using Operational data and Probabilistic Updating, **PVP2022-84526**, Las Vegas, July 2022



Use of Plant Data





Why Automate?



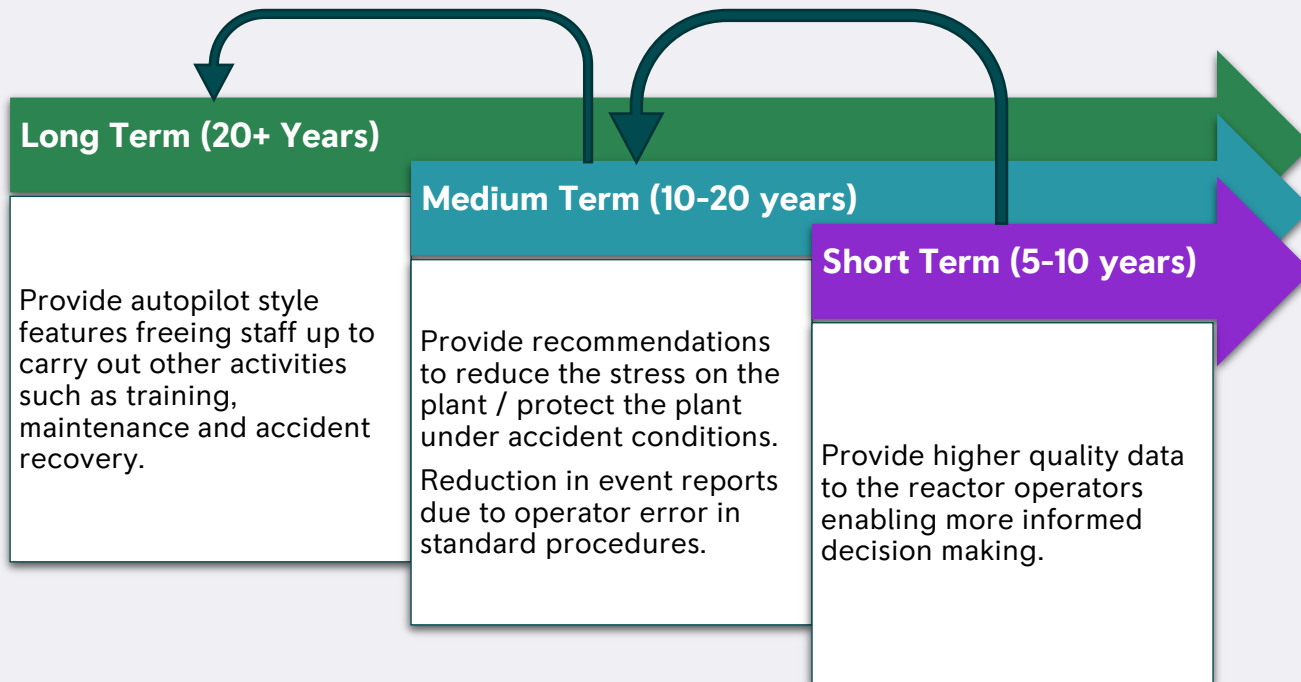
Various studies have looked at automation in the past, what has changed?

- Increased computational power and the development of open source tools is enabling the production of cutting edge AI systems.
- Rapid progress is being made in other sectors (Defence, Automotive, etc.) that could be seen as a leading indicator for wider adoption.
- The production of internal powerful tools within the business will provide data required to develop advanced AI systems.
- Customers have recognised the need to leverage digital and push automation across their products.





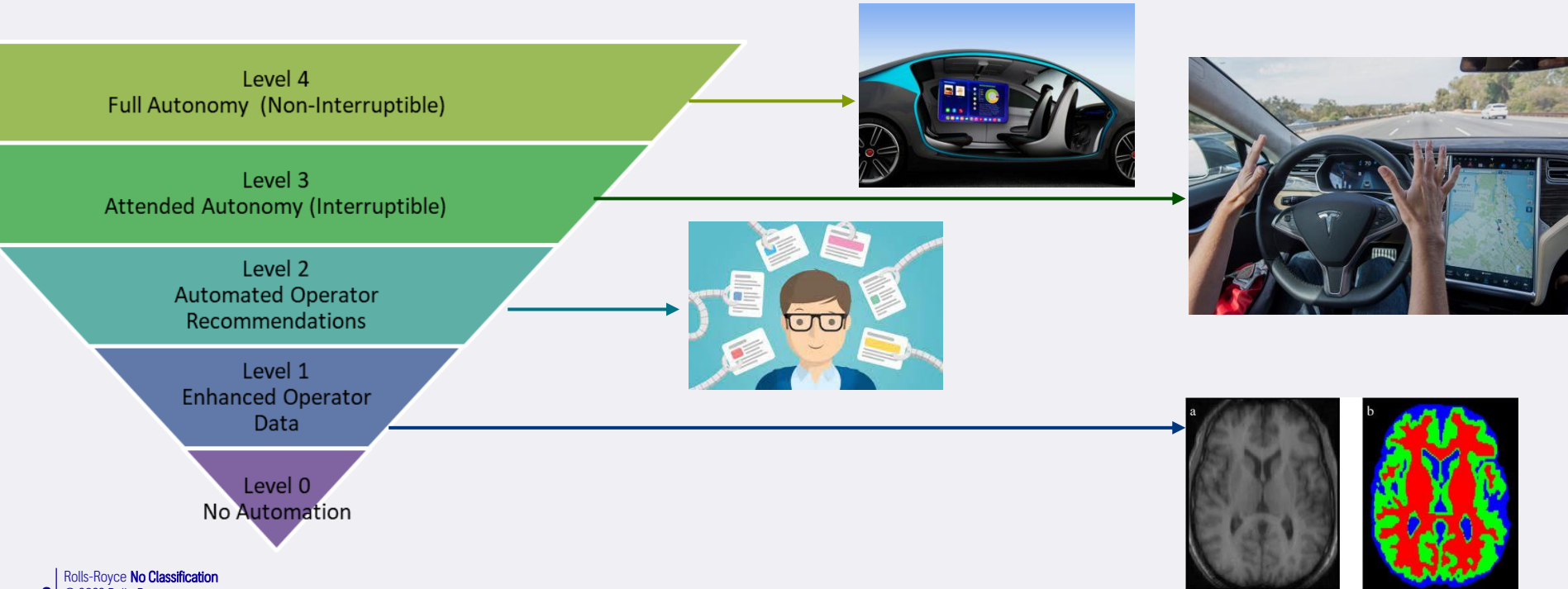
What's the vision for future automation systems?



In all cases, the benefits of automating an individual system needs to be carefully balanced with the development and through life support costs.

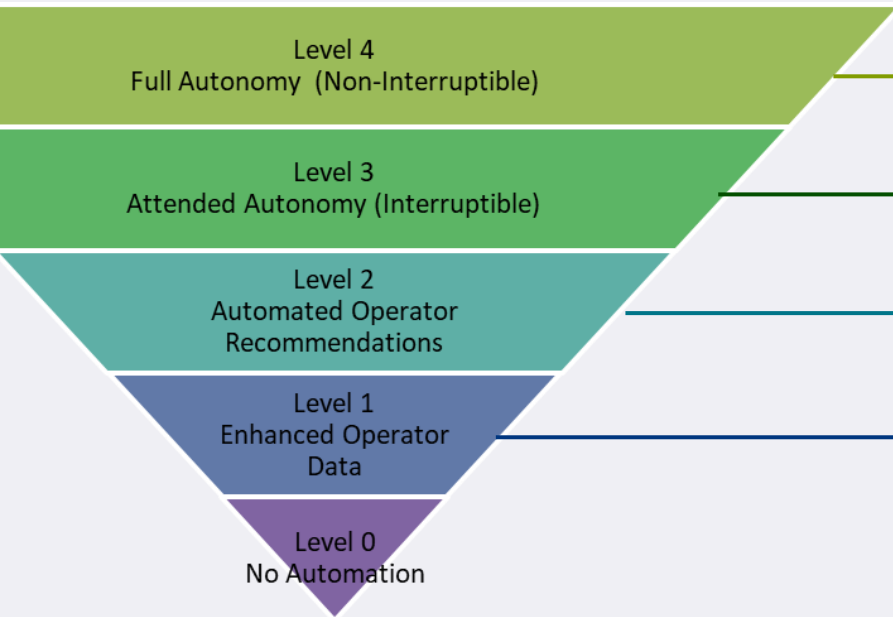
Levels of Automation

Rolls-Royce Model for levels of automation

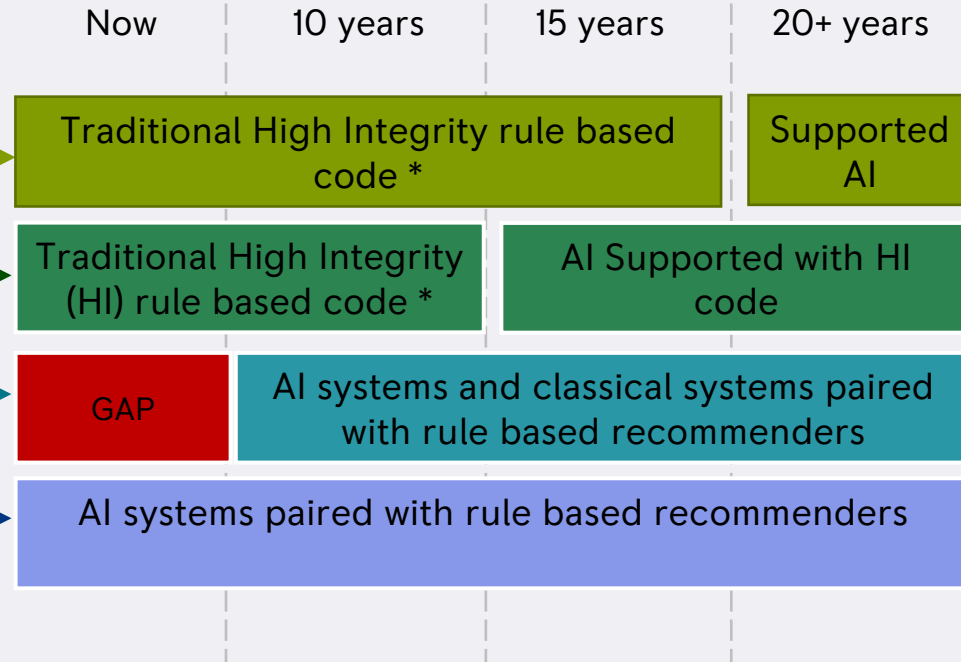


Levels of Automation

Proposed levels of automation



Examples of technology evolution



* For highly deterministic systems



Conclusions

- This presentation highlights some areas where AI could assist the nuclear programmes. Data-centric engineering and automation are just two of the exciting opportunities.
- Building models that work is considered to be viable.
- As yet there is currently no clear route to model qualification for anything nuclear safety related. However, an ONR Expert Panel has been established in UK to take this forward in a regulatory context.

