

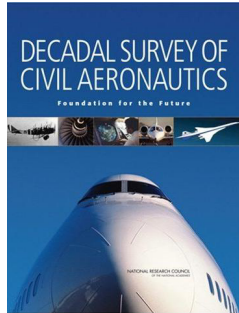


Advanced Software V&V for Civil Aviation and Autonomy

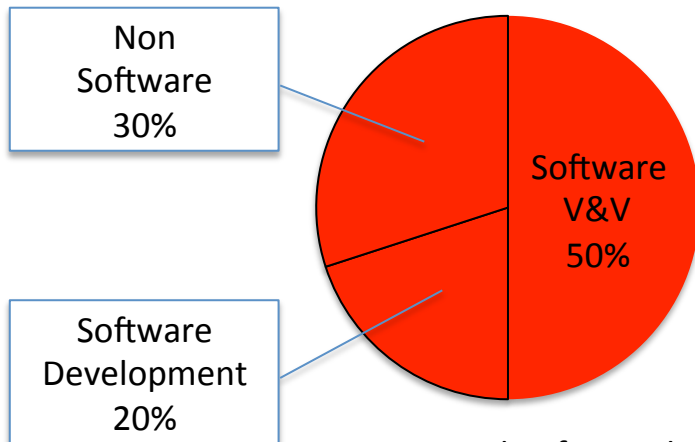
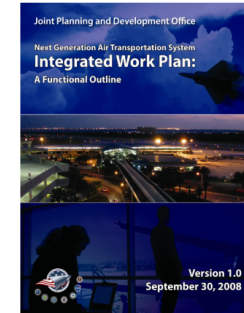
Dr. Guillaume Brat

NASA Ames Research Center

Motivation for V&V research

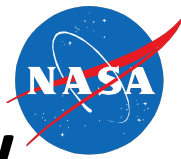


The Decadal Survey for Civil Aeronautics and the NextGen Integrated WorkPlan both call for more research on the validation and verification of complex systems

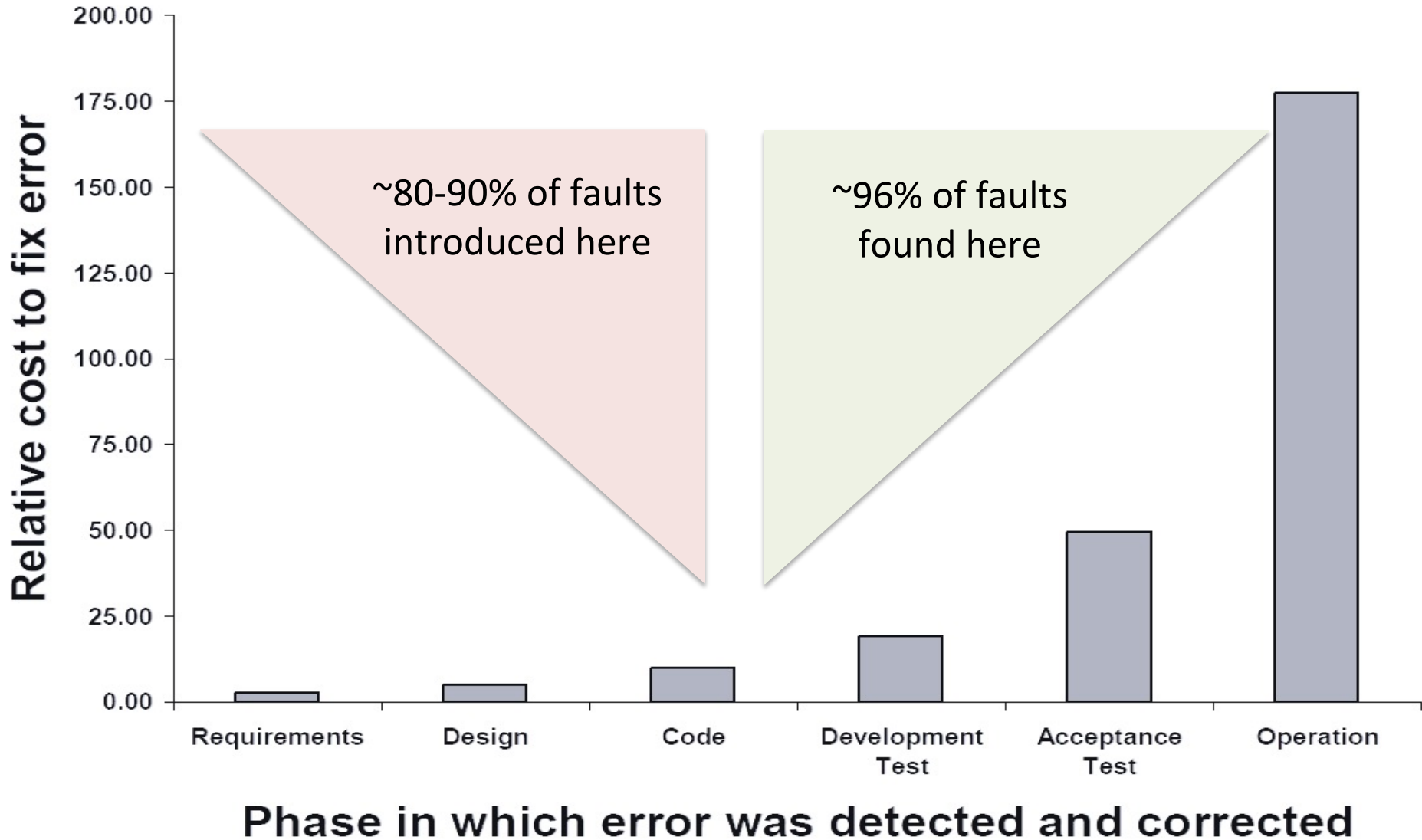


Example of typical cost in Aviation

- Software costs are very high
- V&V cost is 40-50% of the SW cost
- Driven by certification requirements

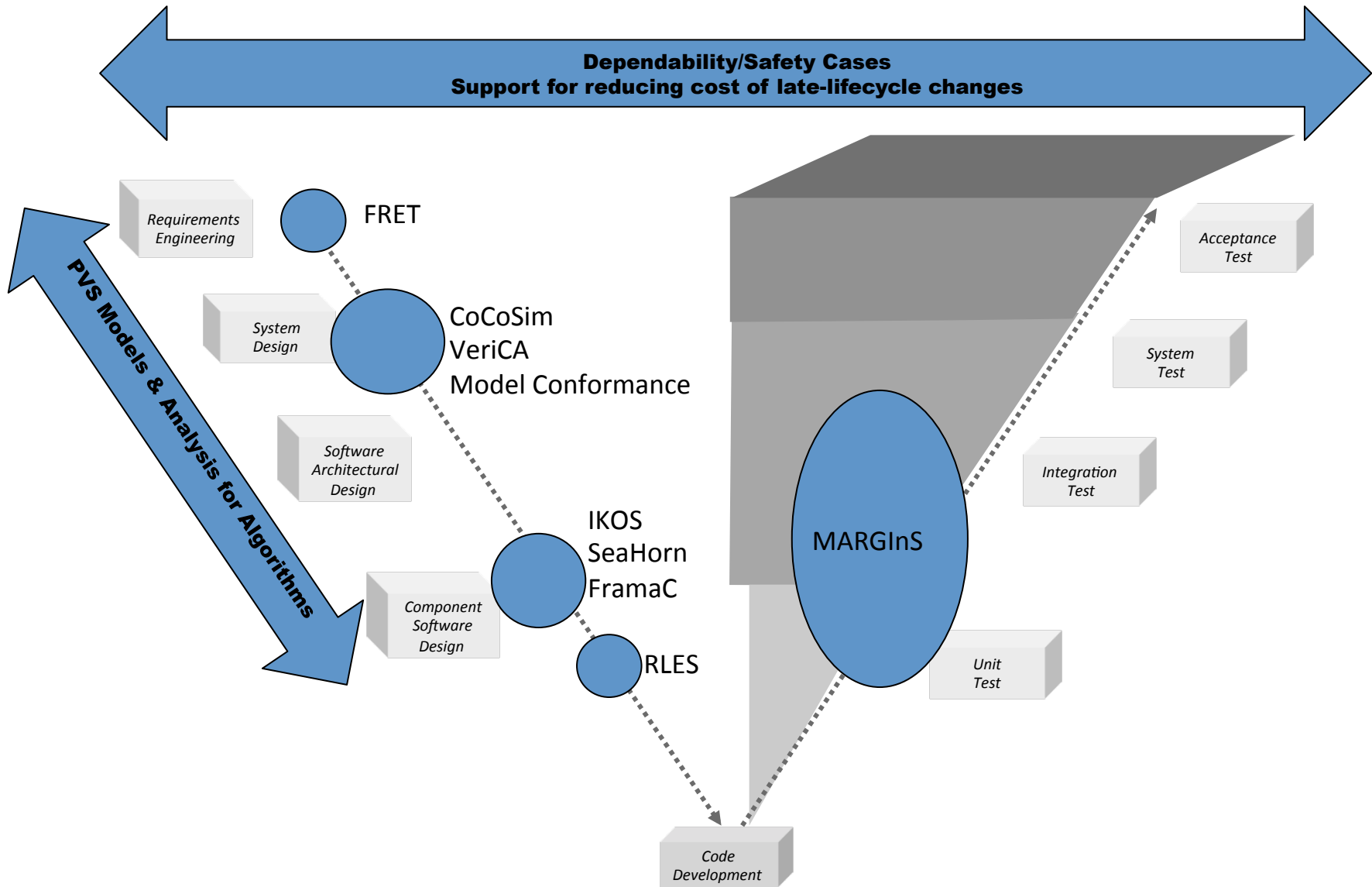


Reasons for the high cost of S/W



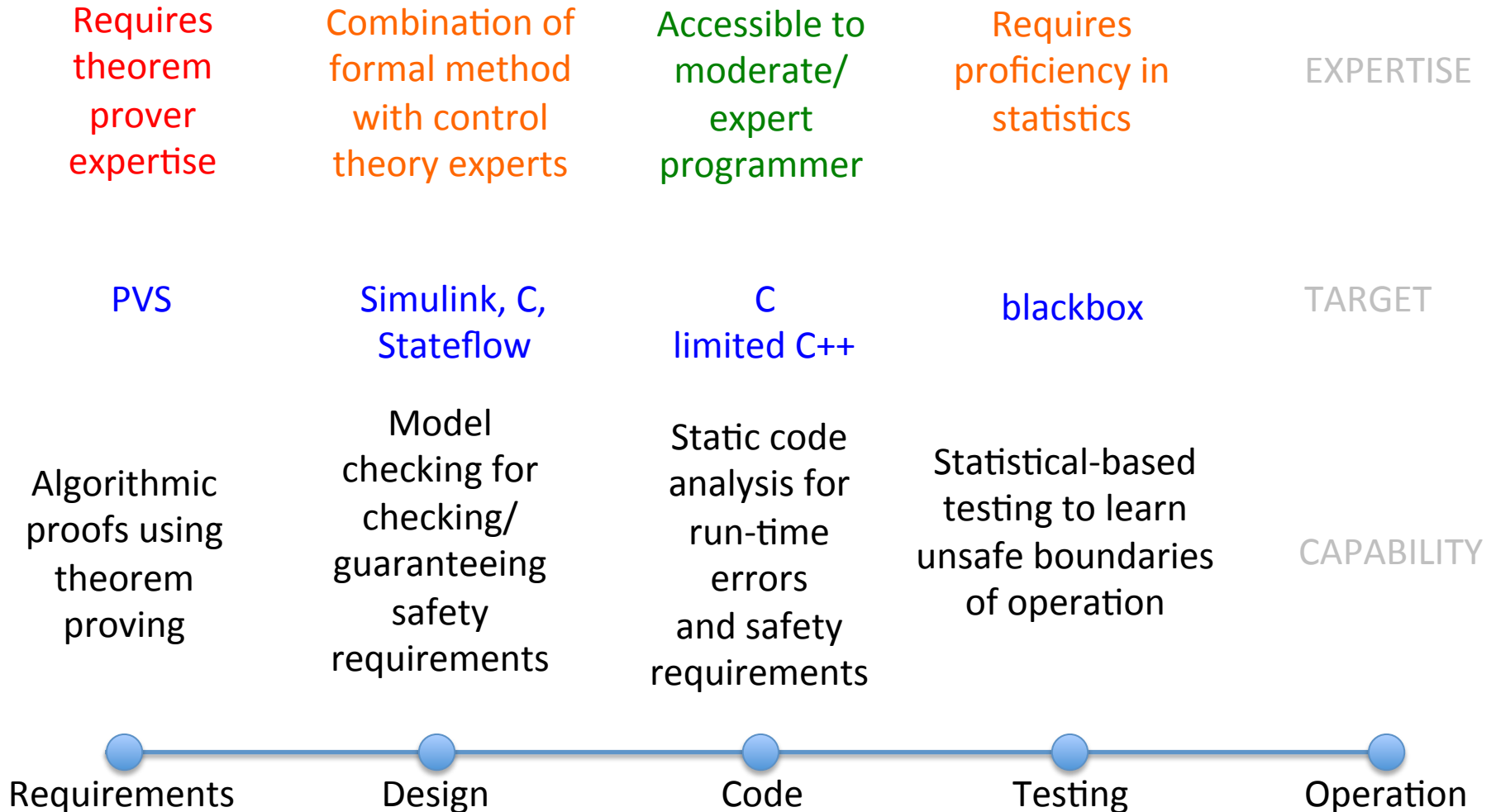


Areas addressed by NASA tools



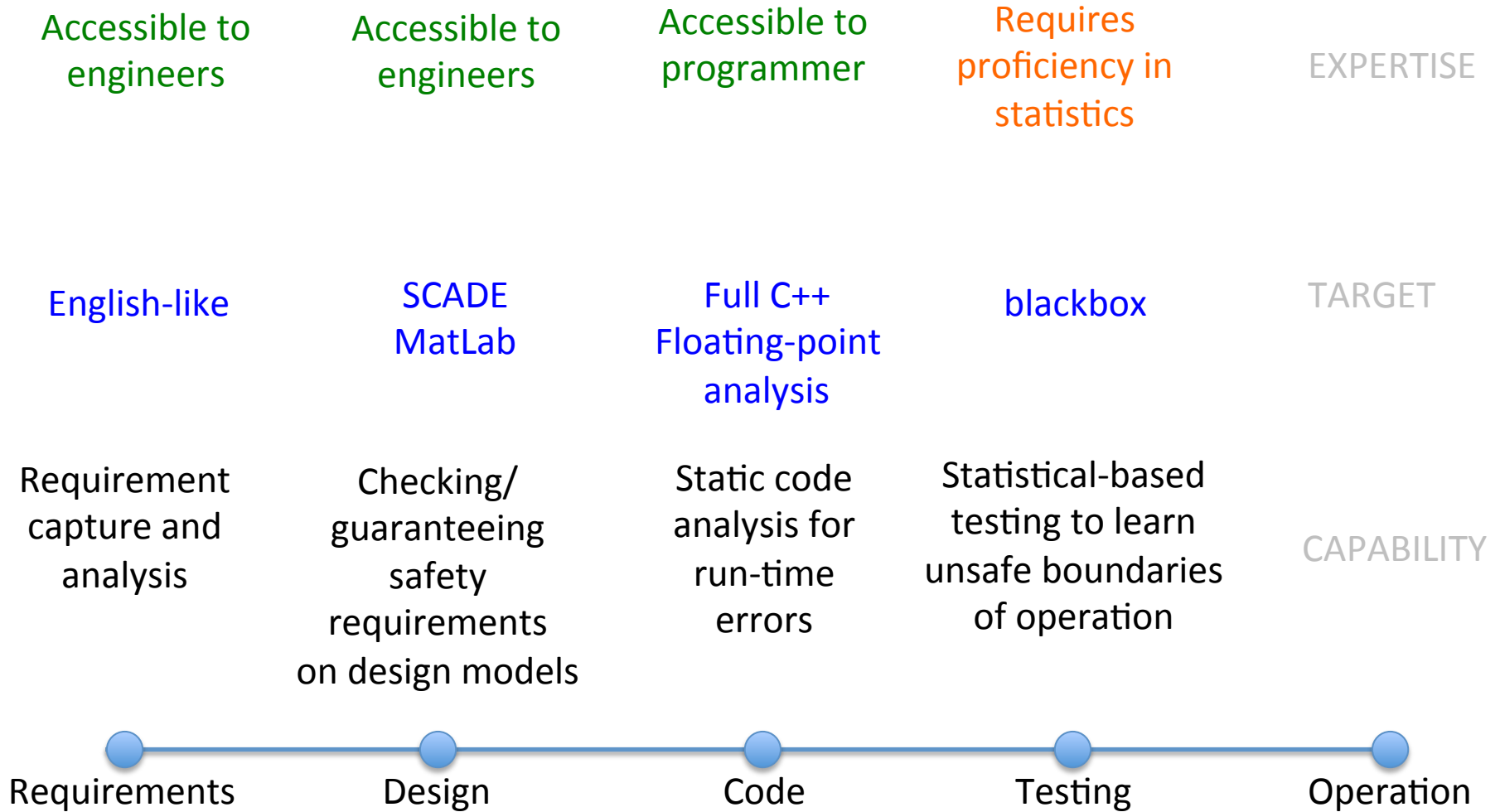


Current V&V Tools and Capabilities



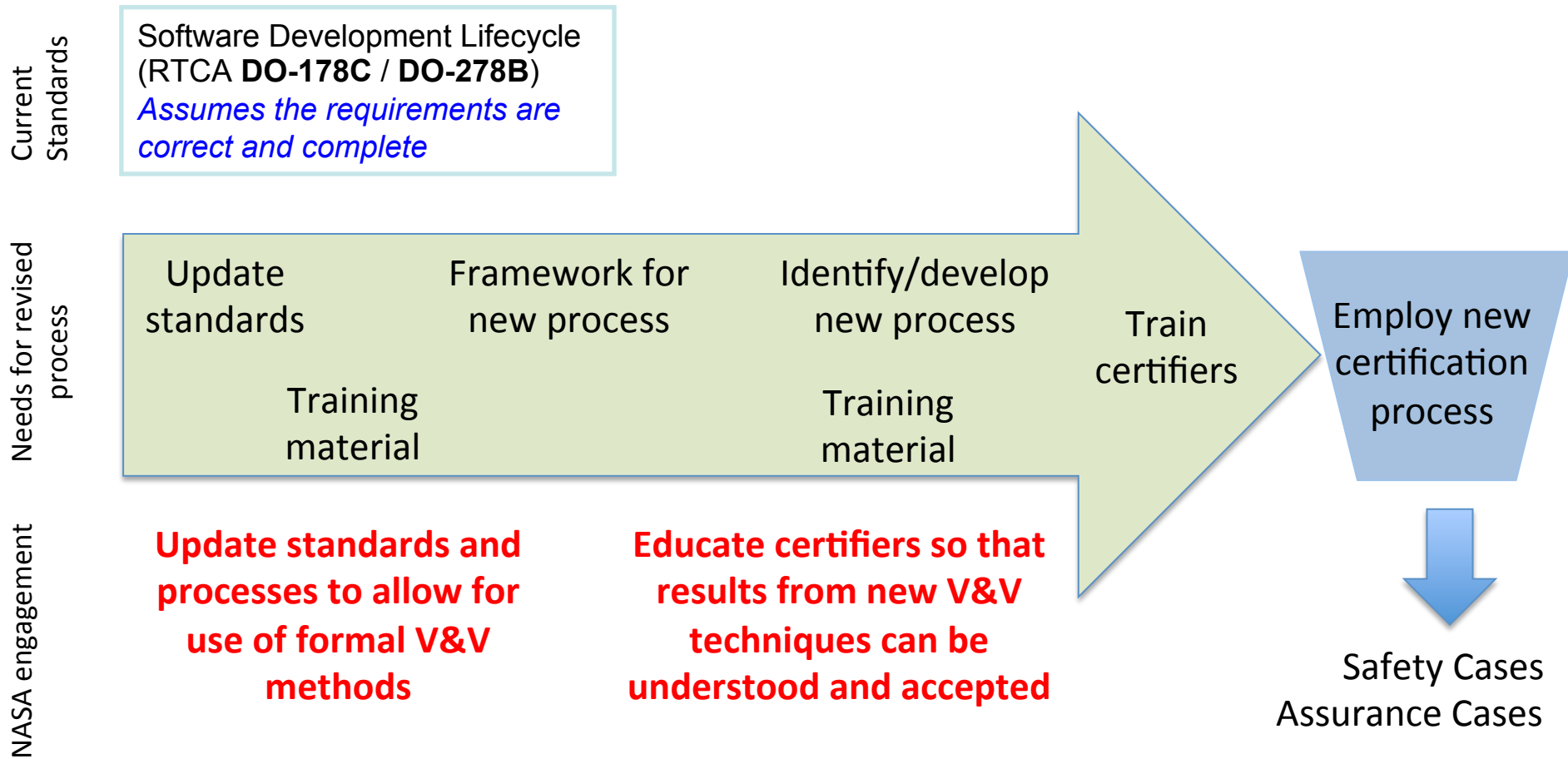


Future V&V Tools and Capabilities





FAA/Regulator Needs





Assurance Cases

- An *assurance case* is
 - A set of assurance claims connected to a body of **evidence** through a structured argument, to provide a comprehensive, defensible and valid justification that **a system meets its assurance requirements** for a given application in a defined operating environment

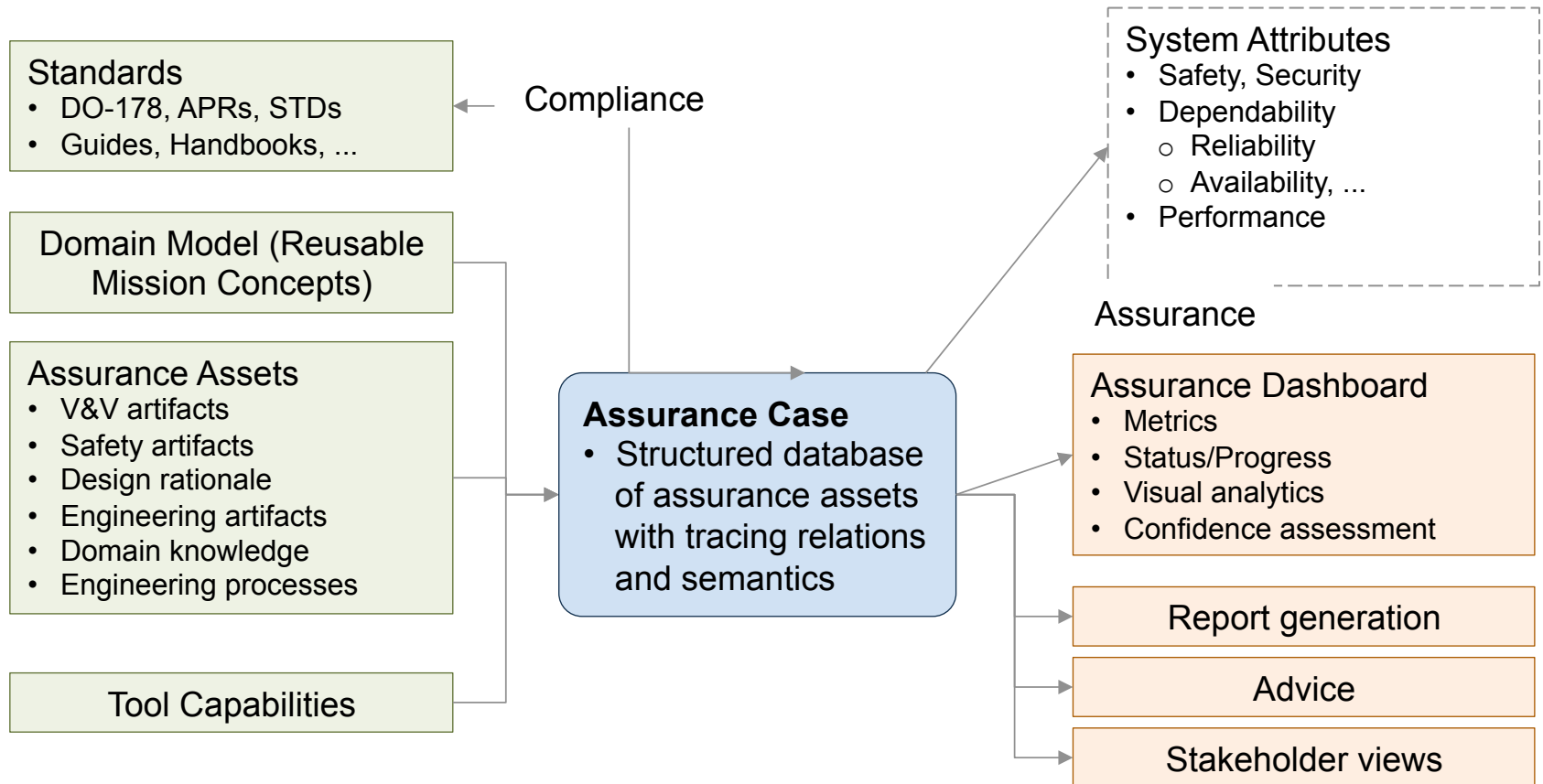
Assurance Case

- Structured database of assurance assets with tracing relations and semantics

- A means for integrating safety and mission assurance (S&MA) information.

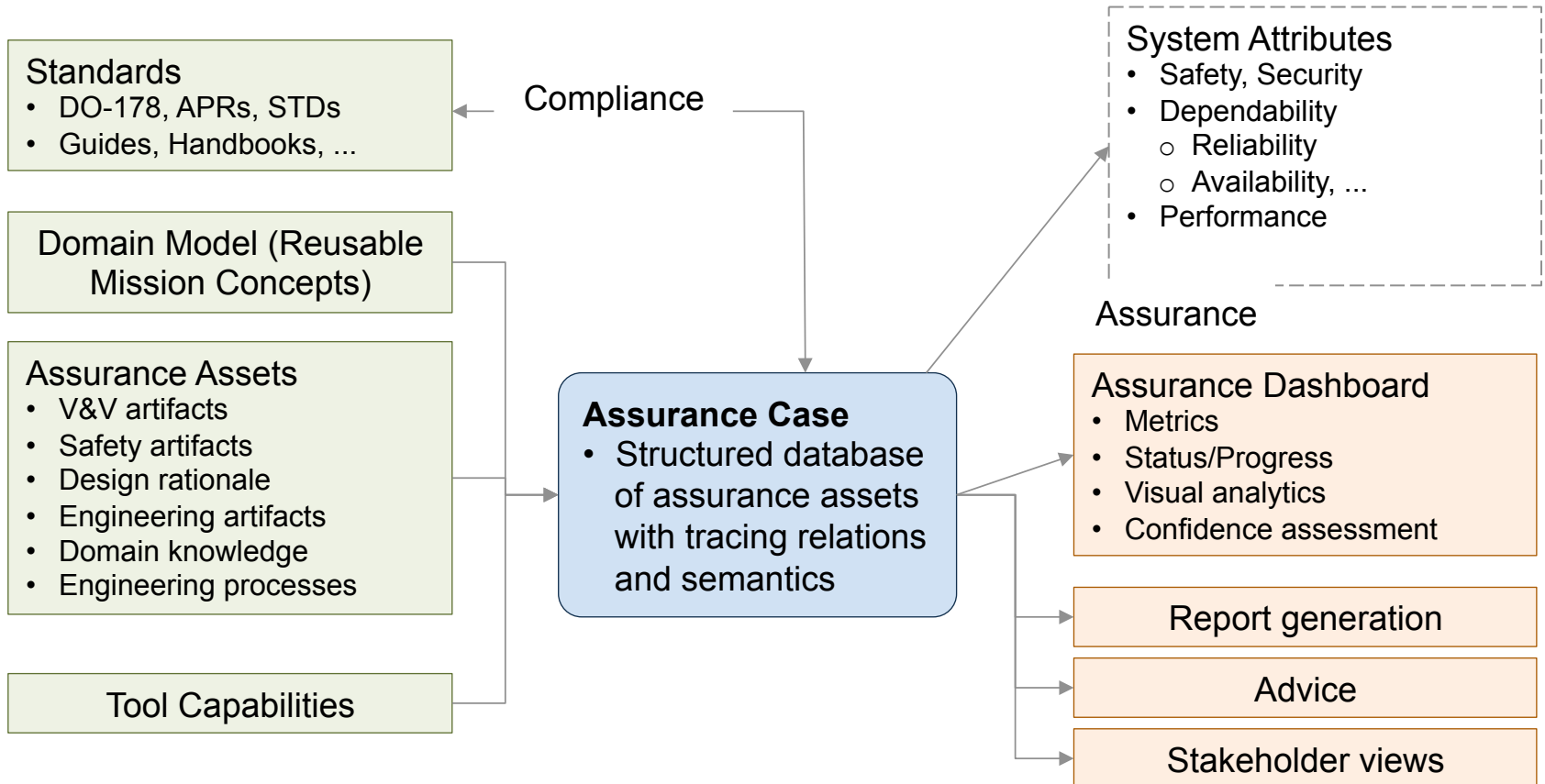
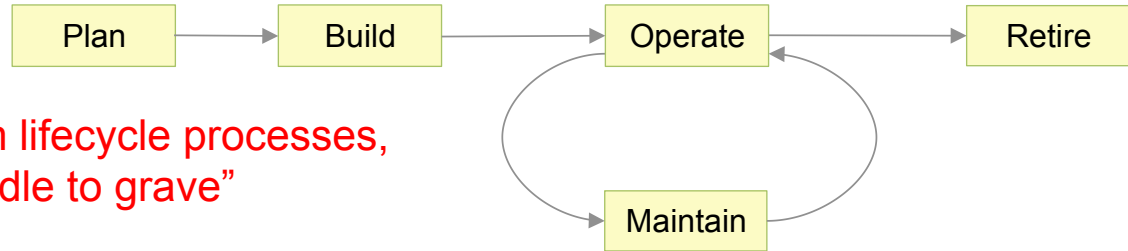


Assurance Cases



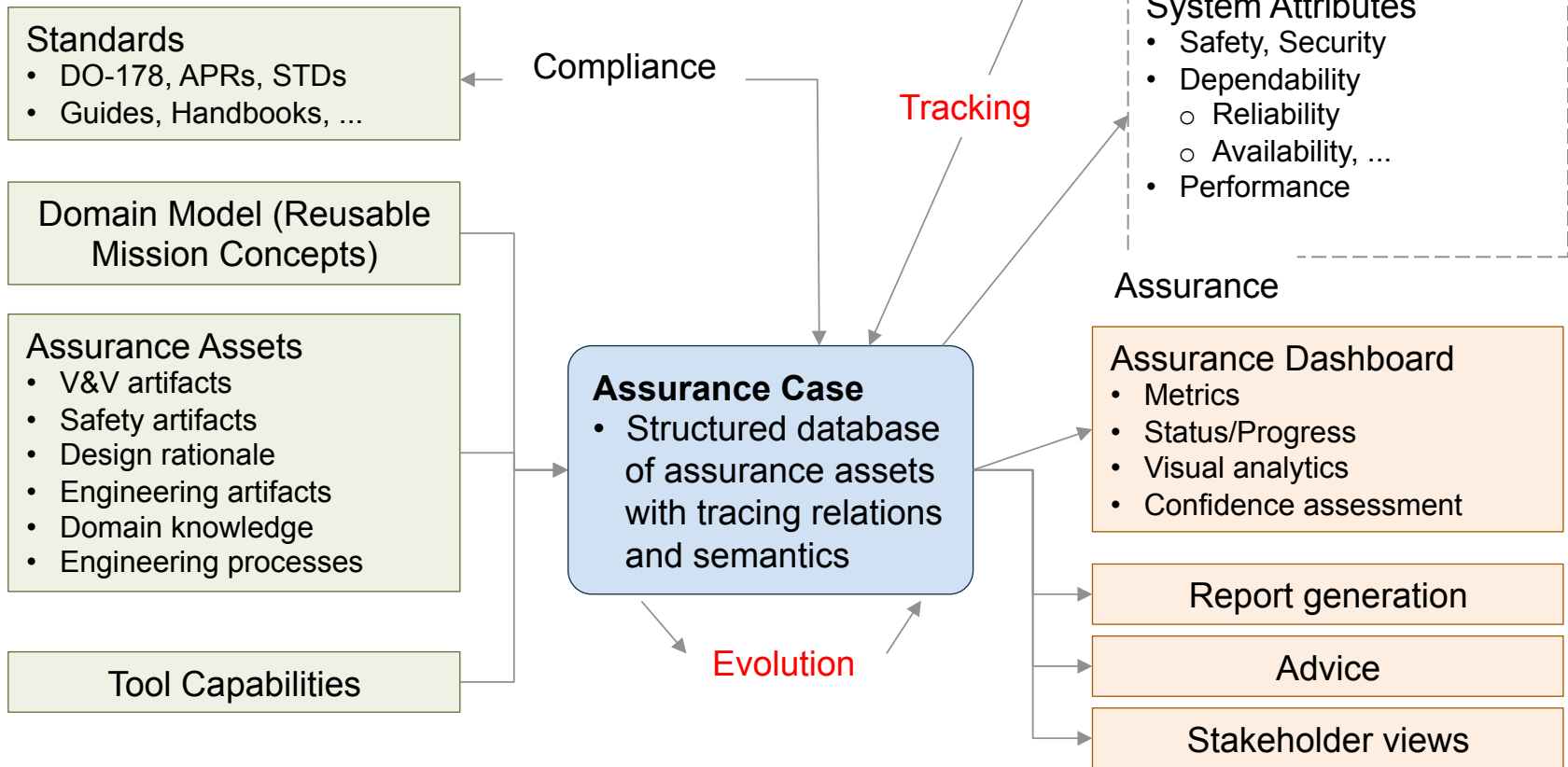
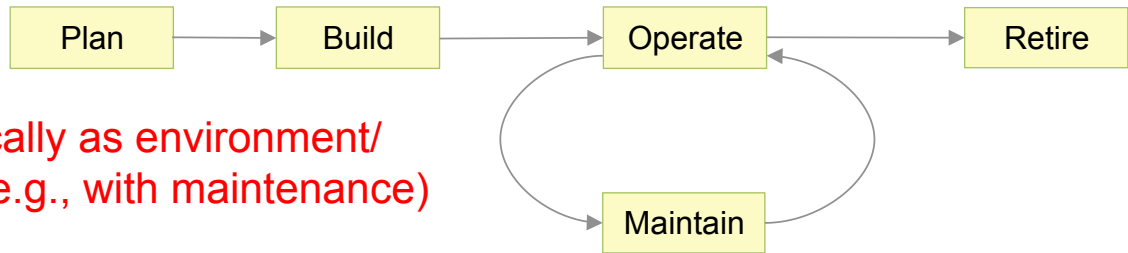


Assurance Cases and Lifecycle



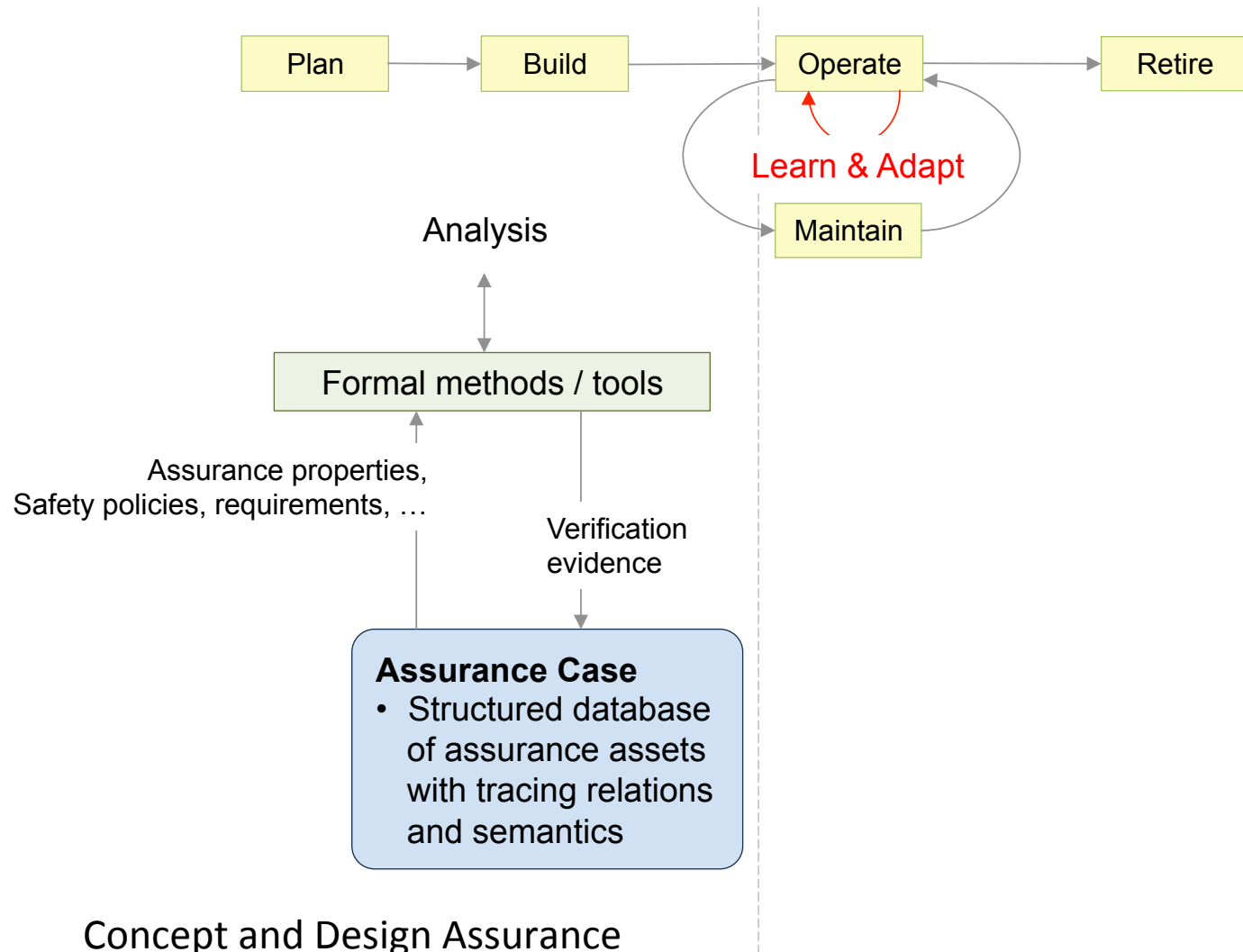


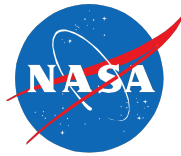
Assurance Cases and Lifecycle



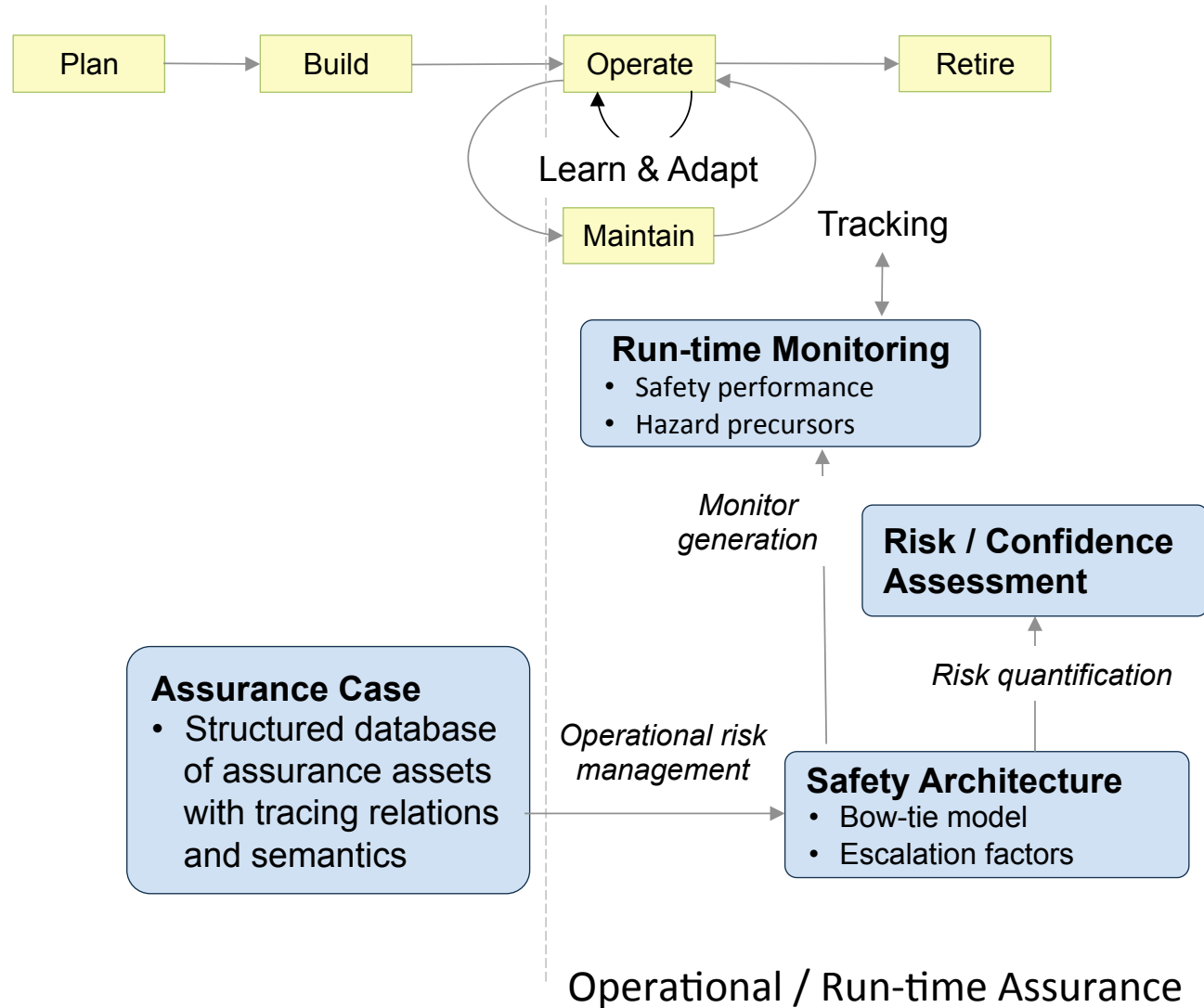


Assurance Cases and Autonomy



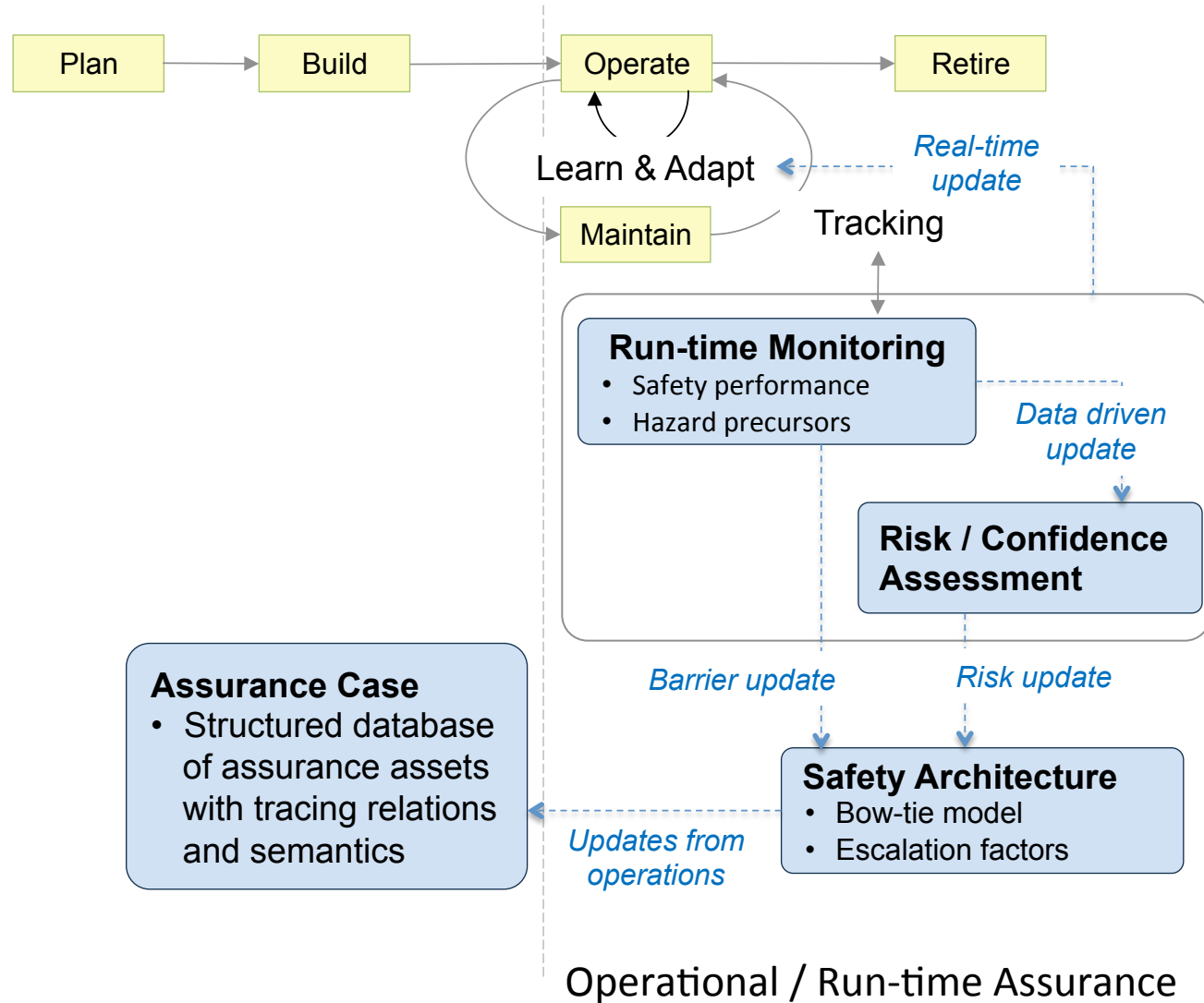


Assurance Cases and Autonomy



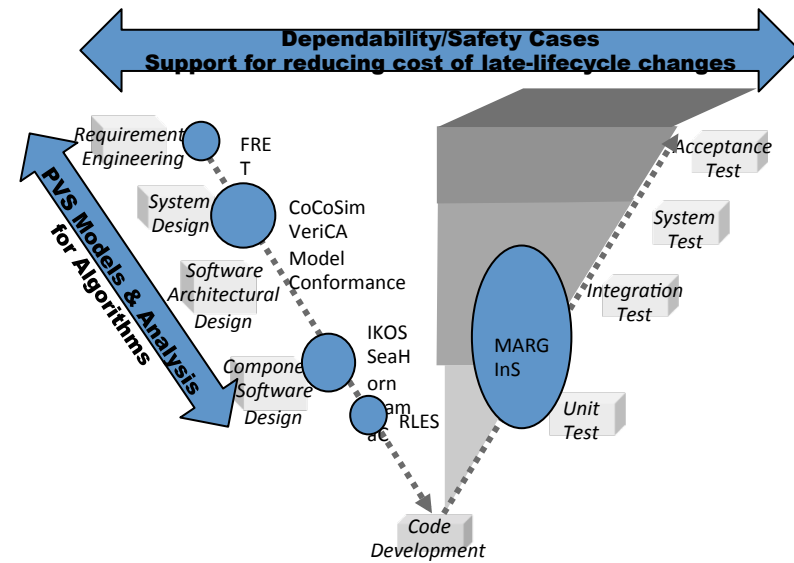


Assurance Cases and Autonomy



Conclusions

- **Goal:** Address the impact of V&V of overall cost of S/W for aviation
- **Solution:** Bring V&V earlier in the lifecycle by using formal methods
- **Status:** Prototype tools for all phases
 - Requirement tool is in its infancy



- **Innovation:** gather V&V evidences in assurance cases that extend throughout the lifecycle
- **Future:** Address V&V of autonomy through the use of assurance cases at runtime