



# Addressing the Complexity Challenge with Adaptive Verification and Validation

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## Topics

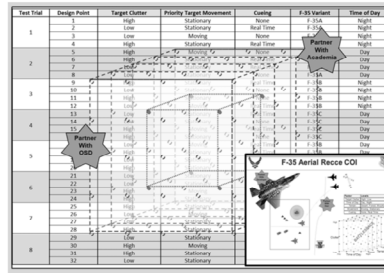


- ✦ Complexity awareness
- ✦ FAA's leadership of adaptive V&V
- ✦ Elements of Adaptive V&V
- ✦ Importance of partnerships
- ✦ Action Plan



# Complexity Awareness

- ✦ Too many system states
- ✦ Don't have enough bandwidth to cover them all
- ✦ Fat tailed probabilities
- ✦ Dynamic, asynchronous, ad hoc exchange of digital data among constituents
- ✦ Surprises



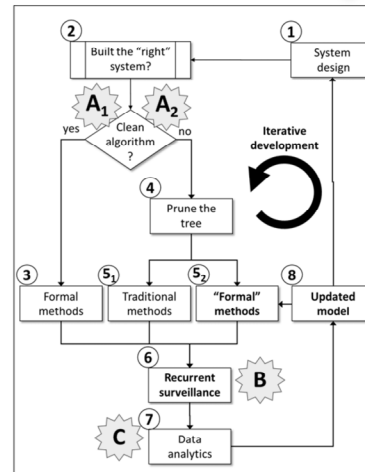
AFOTEC concept of "hypercube" test matrix

What is a "complex" system, anyway?



## A working model

- ✦ How do we deal with the problem of complexity (perhaps unrecognized complexity)?
- ✦ Here's one possible approach...



## FAA Leadership in Adaptive V&V



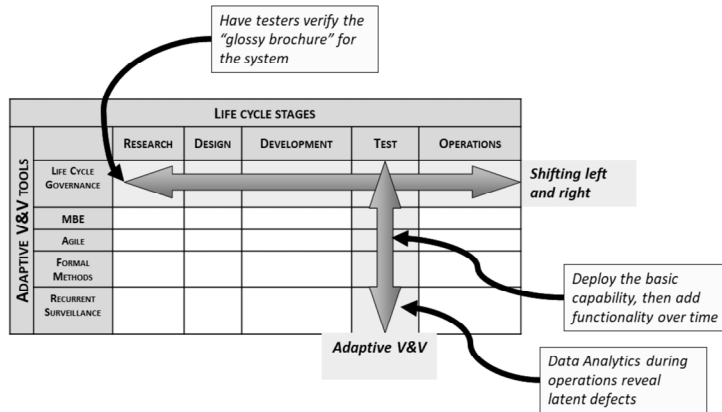
- ✦ Early recognition of the problem (2005)
- ✦ Early application of *all* the adaptive V&V techniques
- ✦ Productive collaboration with:
  - DoD (JMETC)
  - NASA/MITRE (AvSimNet)

THANKS!



## Elements of Adaptive V&V

# Life Cycle Governance

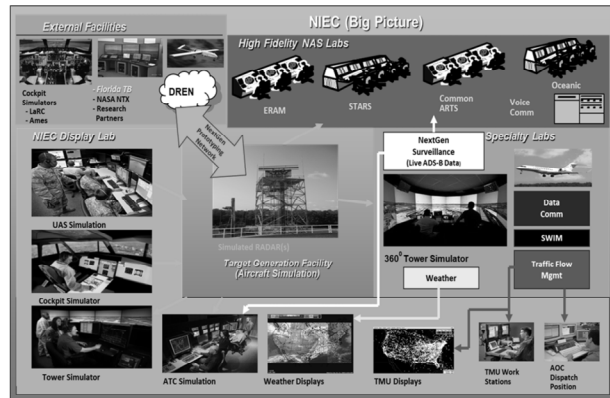


## Iterative Development



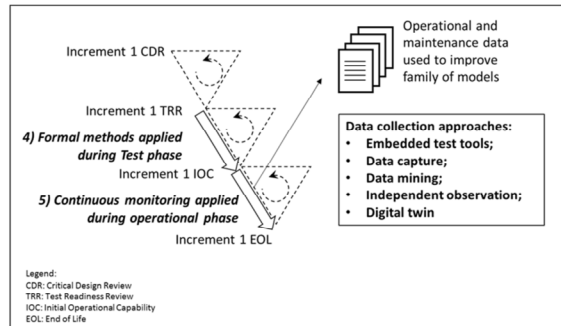
- ✦ Not just, or even exactly, agile methods
- ✦ More the application of agile principles to government acquisitions
- ✦ See Barry Boehm's recent book
- ✦ Lots of examples in FAA

# Model Based Engineering



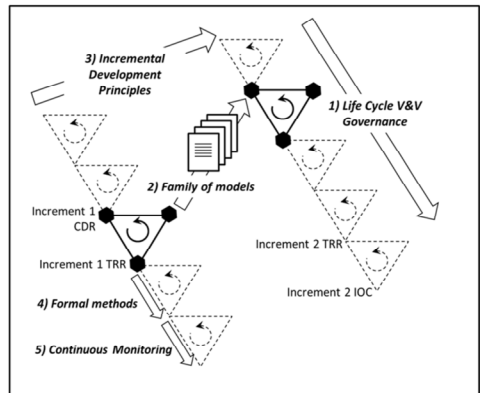
The NIEC/TGF complex IS the MBE core for the NAS!

# Formal Methods and Recurrent Surveillance





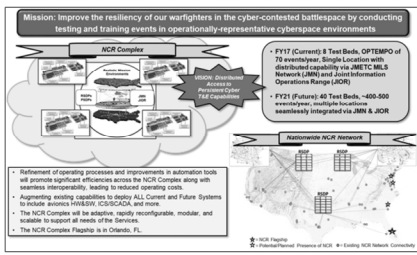
# Summary: The Adaptive V&V Framework





# Importance of Joint/Interagency/ Whole-of-Government Solutions

- ✦ Share best practices
- ✦ Make use of best-in-class facilities and capabilities
- ✦ Partner across agencies
- ✦ Also within agency across stage gates!



## Action Plan



- ✦ Use policy changes to drive V&V “to the left” and also “to the right”
- ✦ Formalize flexible iterative development practices in acquisition regulations
- ✦ Advocate for national policy reform permitting use of real portfolio management
- ✦ Standardized models (from a data definition point of view) so that they can be used to communicate from “later stages of an earlier iteration, to earlier stages of a later iteration.”
- ✦ Formalize the use of recurrent surveillance tools to catch the inevitable but unpredictable emergent behaviors.



## Questions and Discussion