

# What are the prerequisites to effectively using MBSE?

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# Agenda

- What are the most common barriers and enablers to using MBSE?
- Which are the hardest to overcome, and conversely the most persuasive to those reluctant to implement?
- Are, and if so how, are the other MBSE domains (e.g., behavior, architecture/structure, verification and validation) incorporated during the requirements stage?

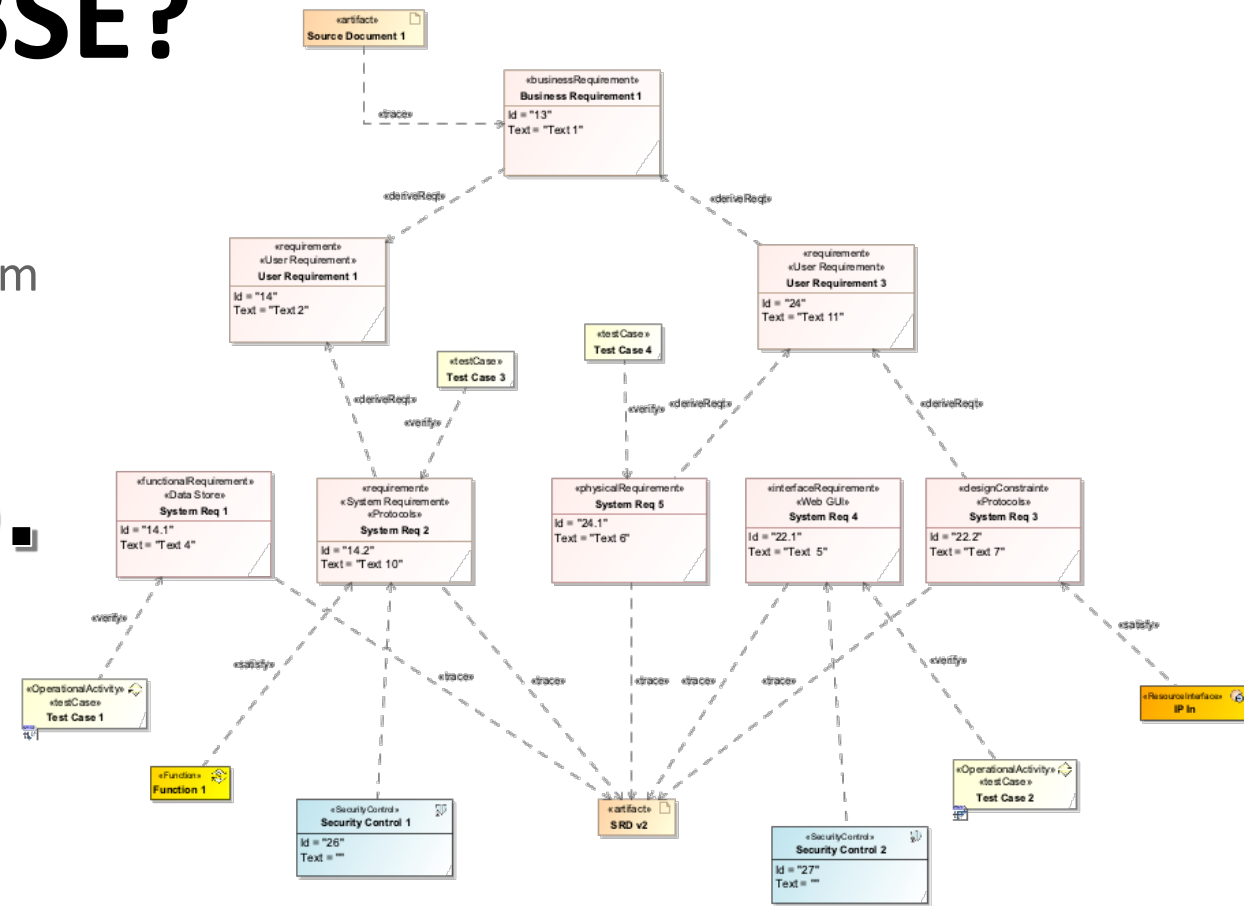


# What are the most common barriers and enablers to using MBSE?

1. The system shall provide a search facility that will allow full-text searching of all web pages that the user is permitted to access. The system must support the following searches:

- find all words specified
- find any word specified
- find the exact phrase
- Boolean search

VS.



Source: [http://web.cse.ohio-state.edu/~bair.41/616/Project/Example\\_Document/Req\\_Doc\\_Example.html](http://web.cse.ohio-state.edu/~bair.41/616/Project/Example_Document/Req_Doc_Example.html)

Source: <https://insights.sei.cmu.edu/blog/requirements-in-model-based-systems-engineering-mbse/>

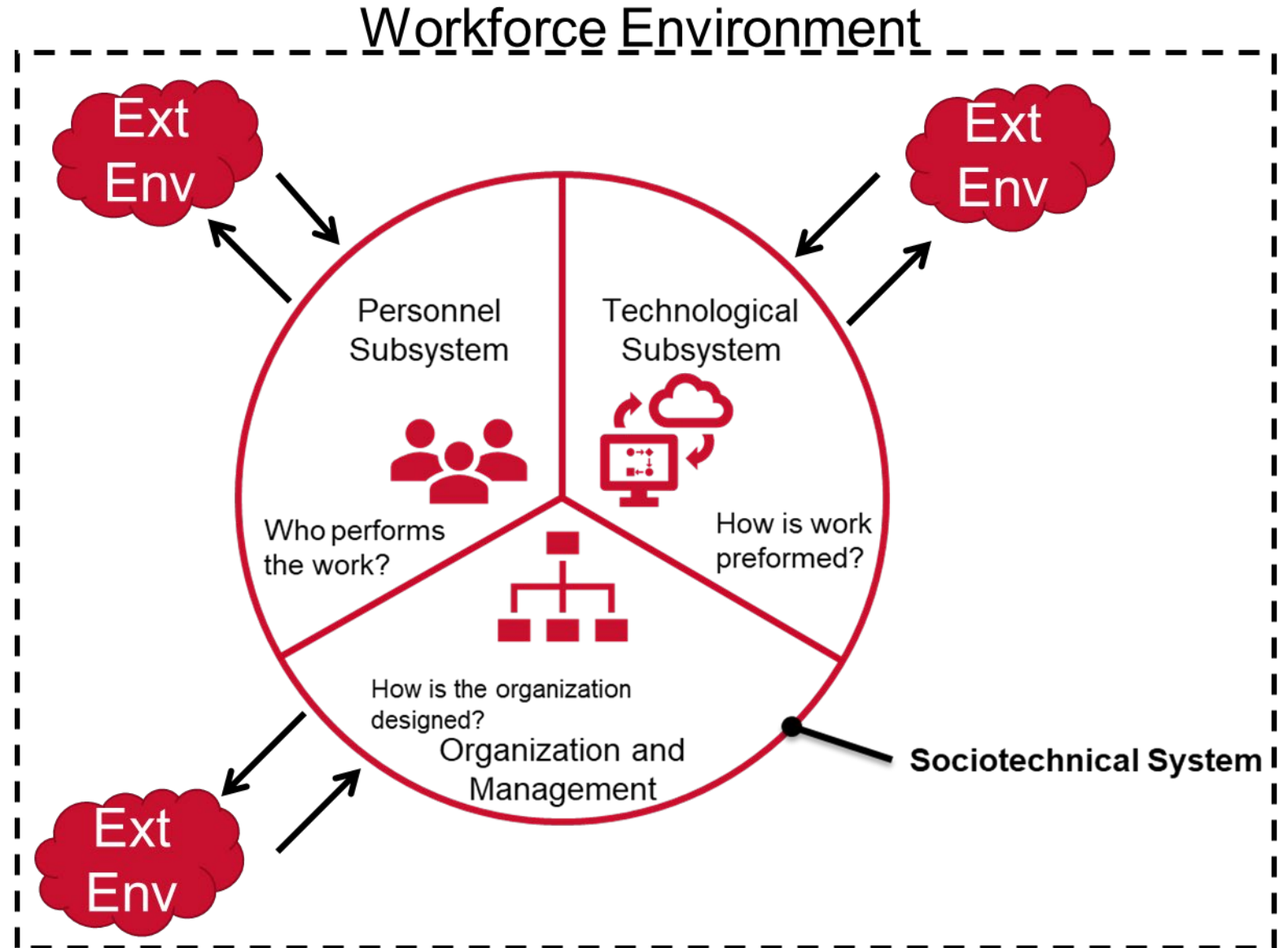


# Sociotechnical System Barriers to using MBSE

Joint Causation

Joint Optimization

Joint Design

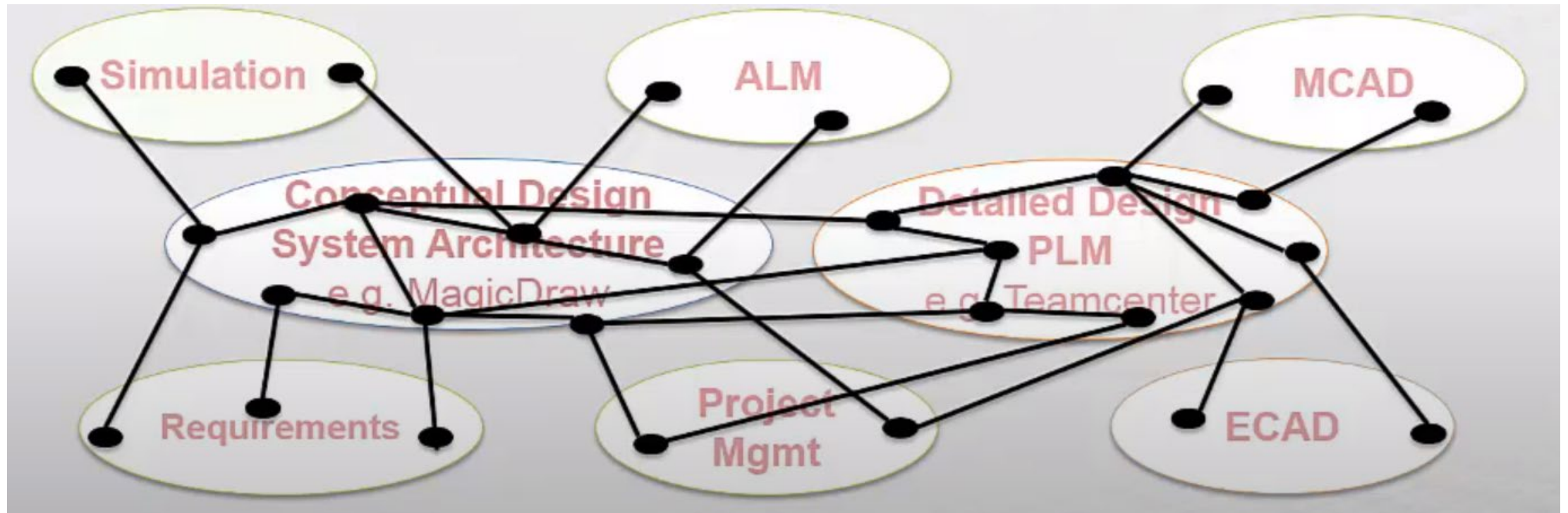


# Which are the hardest to overcome, and conversely the most persuasive to those reluctant to implement?

- Any efforts that do not redesign the work system
  - Personnel: Training is easy and cost effective. Just do it!
  - Technology: Each release of COTS tools are more capable and aligning better with standards
  - Policy: Do not make mountains of mole hills!
- Any efforts that do not embrace using computational systems in the process
  - Personnel: Do not force a change on the workforce and then not let it take advantage of efficient technology
  - Technology: Do you burn \$100 bills to stay warm?
  - Policy: Again, you own it, so change it!



# But wait! There's more...



**Links must span multiple tools, often multiple vendors, that may utilize multiple standards. Technology is the easy challenge to solve, but it is still not trivial.**

*Figure from: Zwemer, D., "Connecting SysML with PLM/ALM, CAD, Simulation, Requirements, and Project Management Tools", Interax LLC, May 2011. <https://www.youtube.com/watch?v=E9Xkc4RoaN0>*





# Are, and if so how, are the other MBSE domains incorporated during the requirements stage?

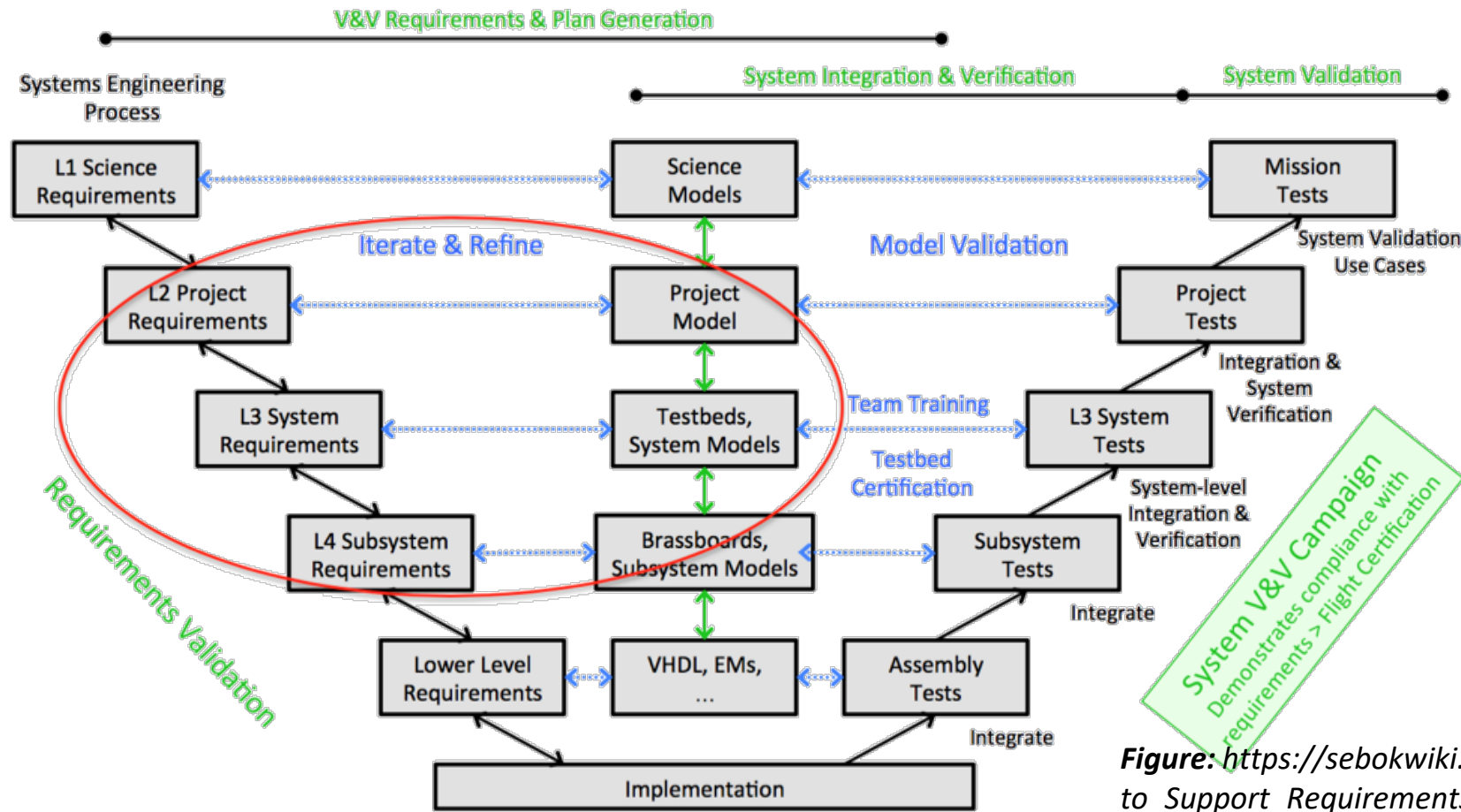


Figure: [https://sebokwiki.org/wiki/Applying\\_a\\_Model-Based\\_Approach\\_to\\_Support\\_Requirements\\_Analysis\\_on\\_the\\_Thirty-Meter\\_Telescope](https://sebokwiki.org/wiki/Applying_a_Model-Based_Approach_to_Support_Requirements_Analysis_on_the_Thirty-Meter_Telescope)



# Cheater! How is it really done?

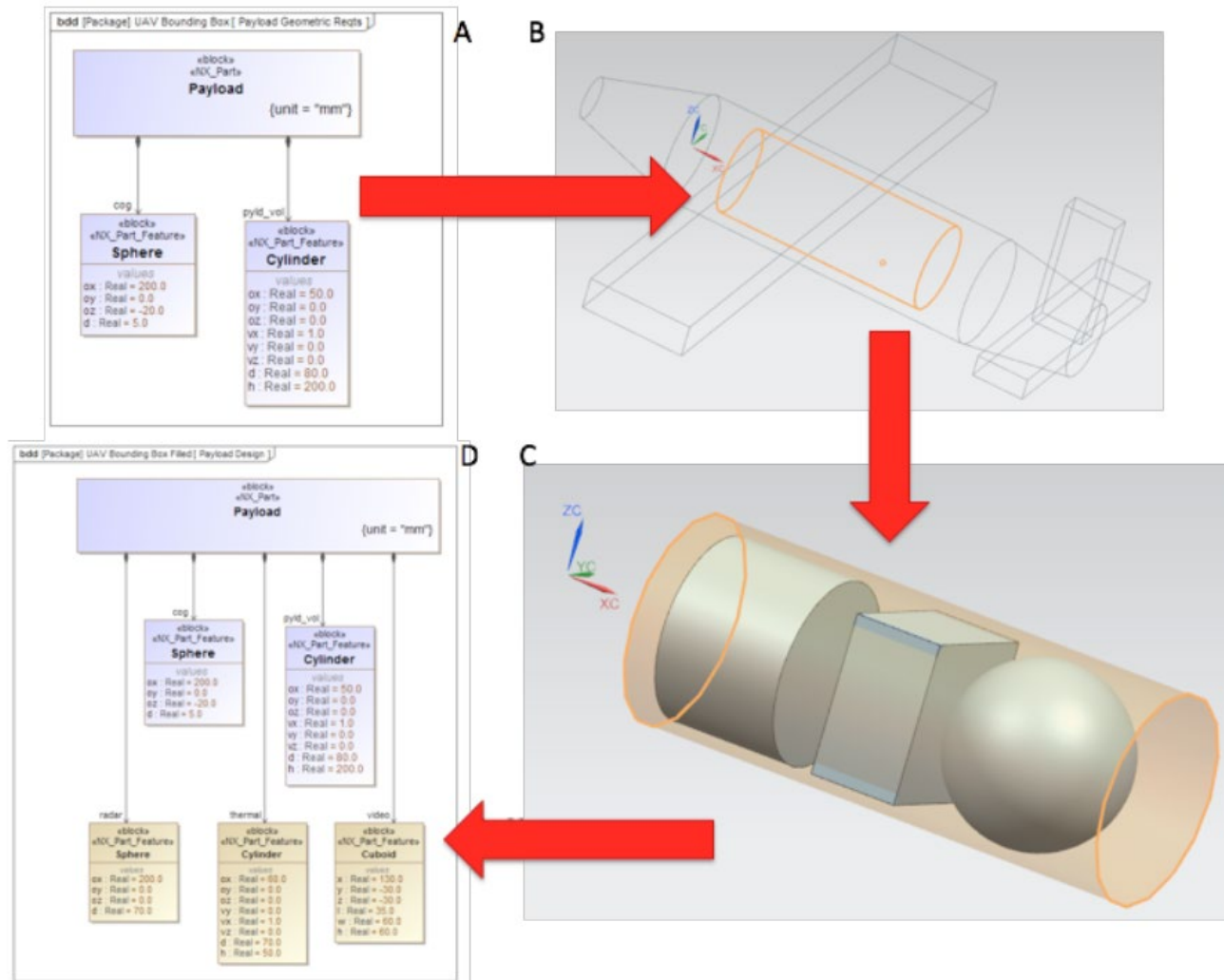
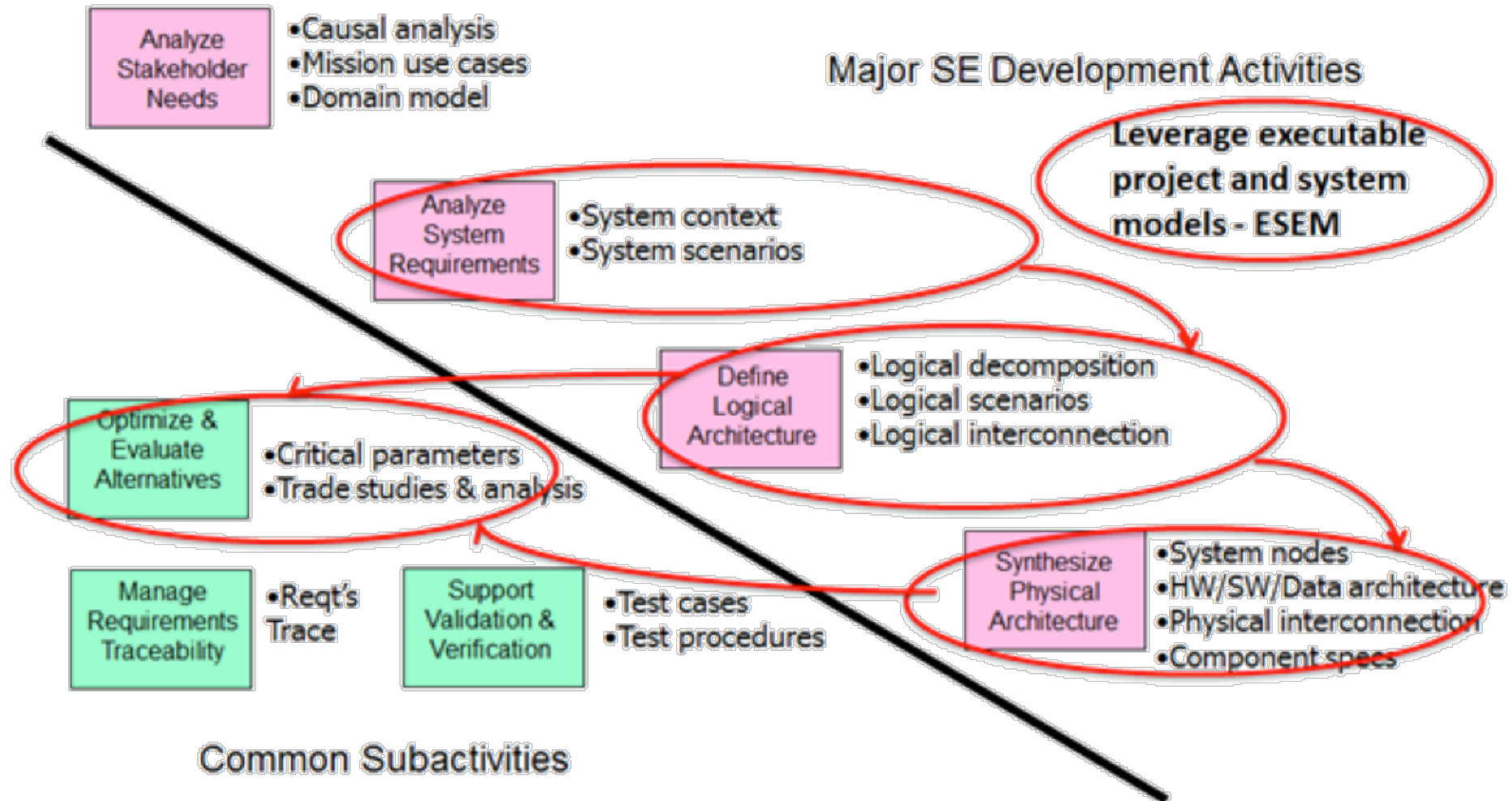


Figure From: Bajaj, M., Cole, B., & Zwemer, D. (2016). Architecture To Geometry - Integrating System Models With Mechanical Design. In *AIAA SPACE 2016*. American Institute of Aeronautics and Astronautics. <https://doi.org/10.2514/6.2016-5470>



# Object Oriented Systems Engineering Method (OOSEM)



Friedenthal, S., Moore, A., & Steiner, R. (2015). *A practical guide to SysML : the systems modeling language* (Third edit, p. xxiii, 606 pages).

Figure: [https://sebokwiki.org/wiki/Applying\\_a\\_Model-Based\\_Approach\\_to\\_Support\\_Requirements\\_Analysis\\_on\\_the\\_Thirty-Meter\\_Telescope](https://sebokwiki.org/wiki/Applying_a_Model-Based_Approach_to_Support_Requirements_Analysis_on_the_Thirty-Meter_Telescope)





# **In Closing,**

**What are the prerequisites to effectively using MBSE?**

**Jointly understanding the needs of your people, technology, and policies. Do not go blindly into deploying MBSE as only a technology project.**

# Thank you!

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