



# Systems Engineering: Systematic Innovation for Hard Target Fuzing

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# Objective

To do effective product development, a systematic and rigorous approach to innovation is necessary. Standard models of system engineering provide that approach.

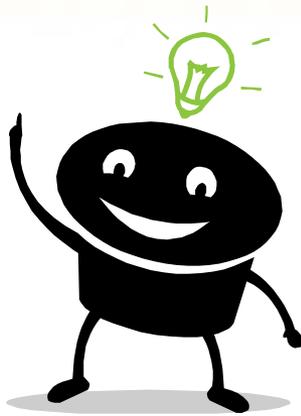
*The popular picture of innovators – half pop-psychology, half Hollywood – makes them look like a cross between Superman and the Knights of the Round Table. Alas, most of them in real life are unromantic figures ...*

— Peter Drucker, *The Essential Drucker*, Principles of Innovation

# Two Views of Innovation

## Flash of Genius

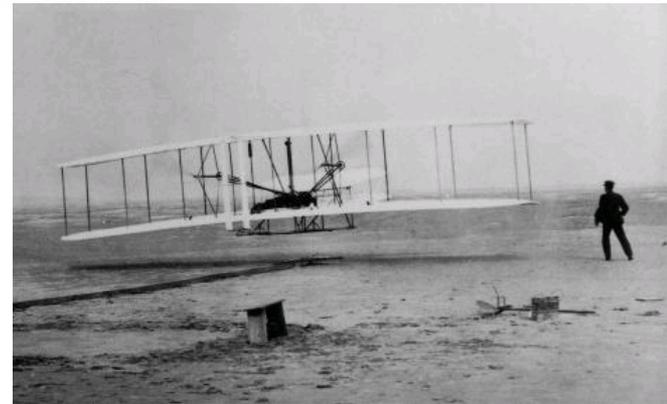
Innovation is an unexpected, brilliant idea



- **Cannot** be taught
- **Cannot** be reproduced
- **Cannot** be scaled to
- Typically unknown risk

## Hard Work

Innovation is systematic exploitation of opportunities through analysis



- **Can** be taught
- **Can** be reproduced
- **Can** become a culture
- Typically **risk aware**

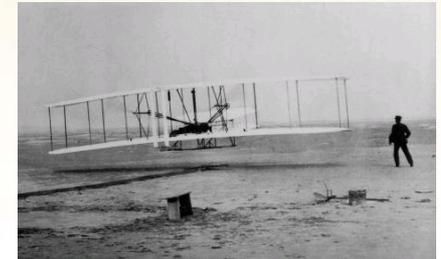
Which view would you base a business or project on?

# Innovations vs Great Ideas



## Great Ideas

- Undefined impact
- No immediate utility; perhaps in the future
- Complex
- Not necessarily aligned with a specific need or outcome



## Innovations

- Economic and social impact
- Has utility immediately
- Simple, focused
- Applied to a specific, clear and defined application

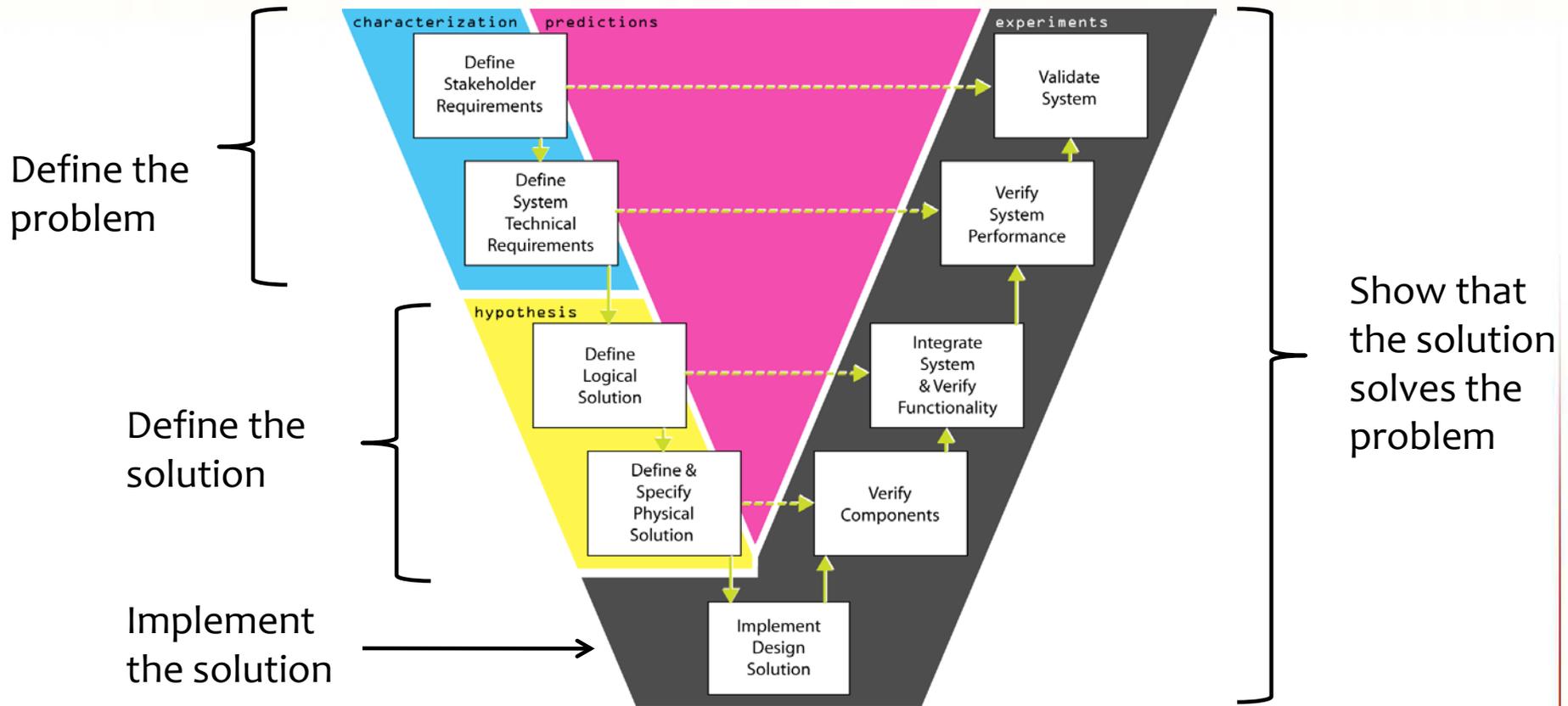
*... the innovation that creates new uses and new markets should be directed toward a **specific, clear, designed application**. It should be focused on a specific need that it satisfies, on a specific end result that it produces.*

— Peter Drucker, *The Essential Drucker*

# One Slide Introduction to the System Engineering Process

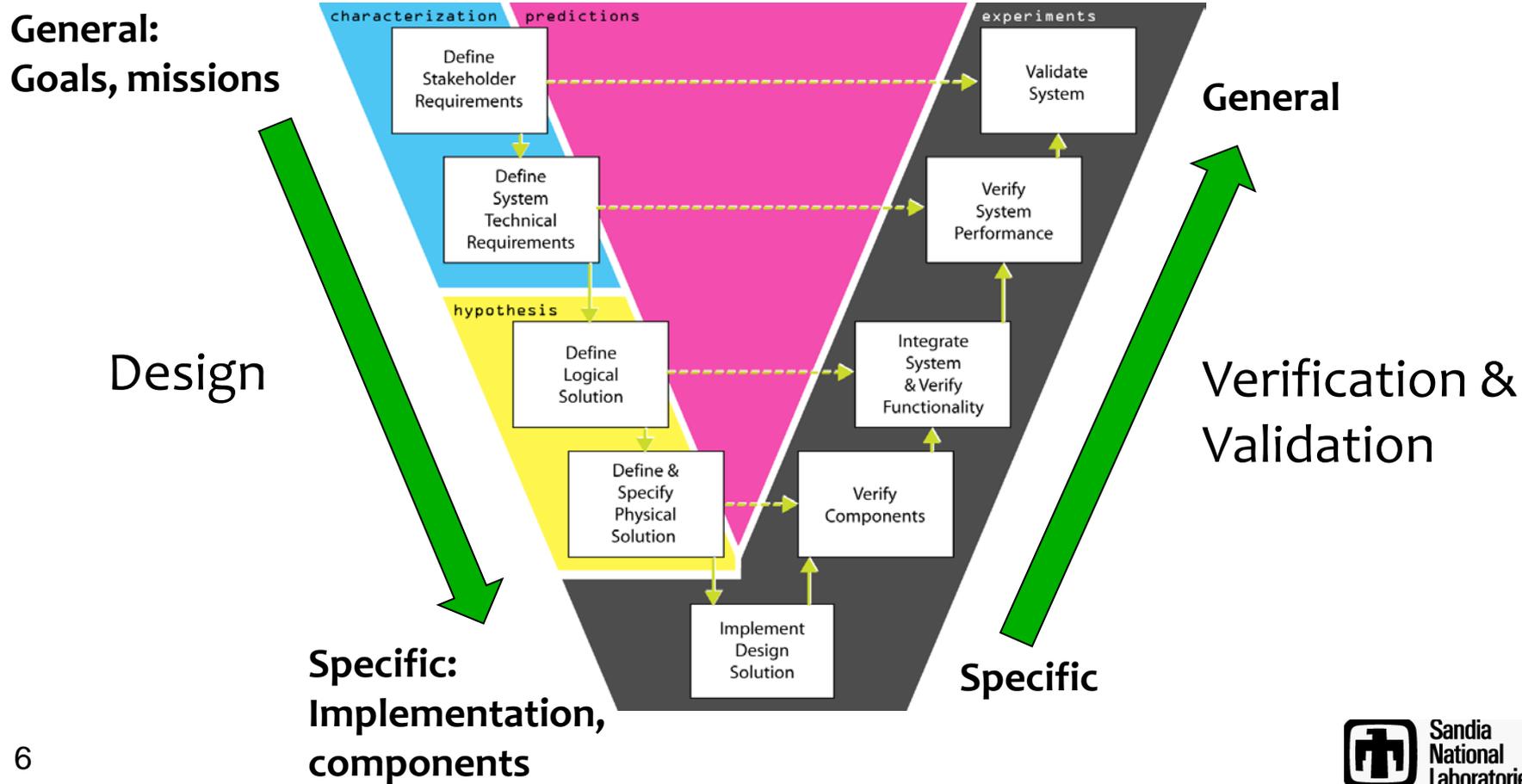
The V-model is the predominant model of the system engineering process:

This V-model is based on EIA-632, *Processes for Engineering a System*



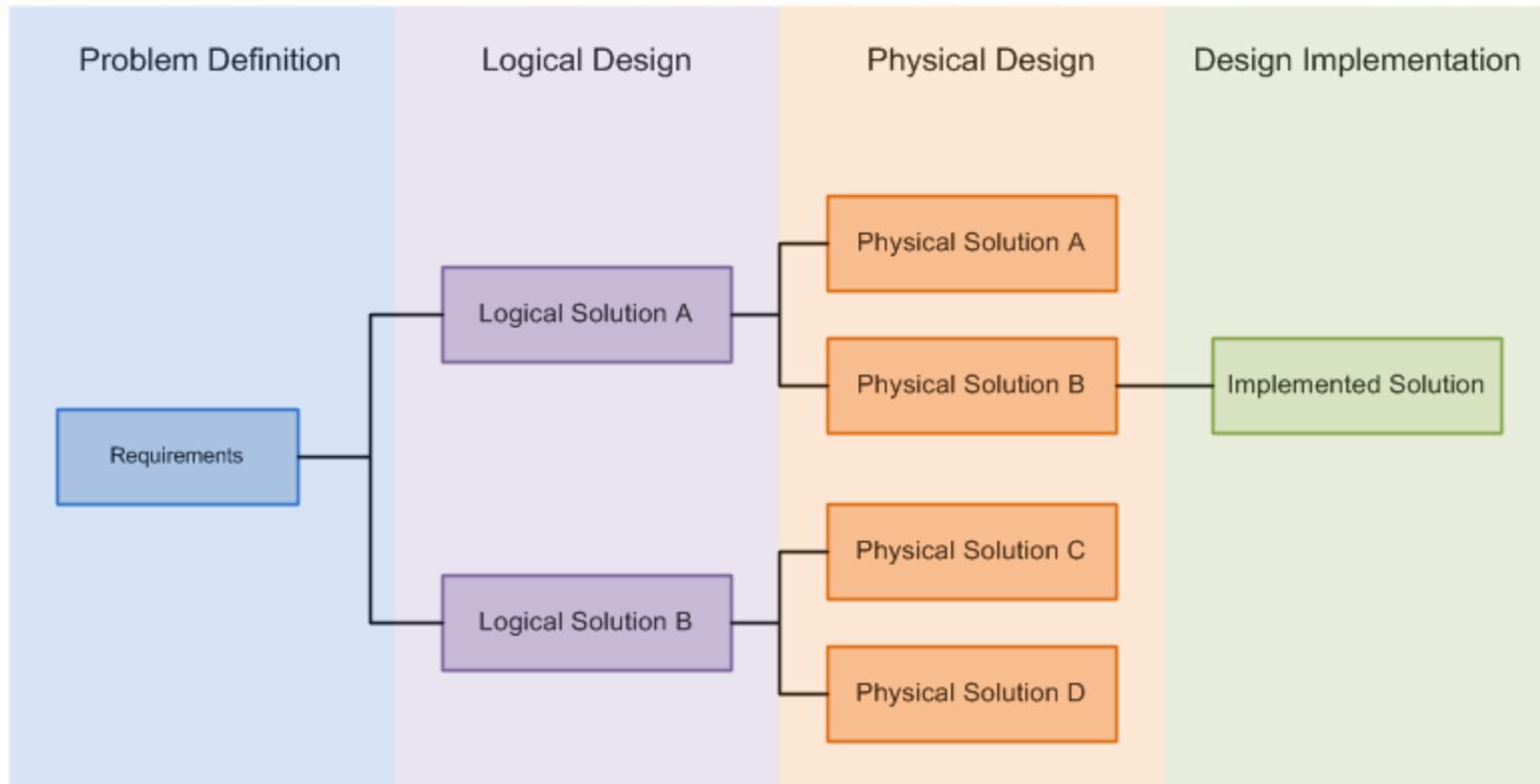
# The V-Model and Innovation

- The key to the V-model is in progression from general concepts to a specific solution
- This allows for **systematic** exploration of the solution space



# The V-Model in Action

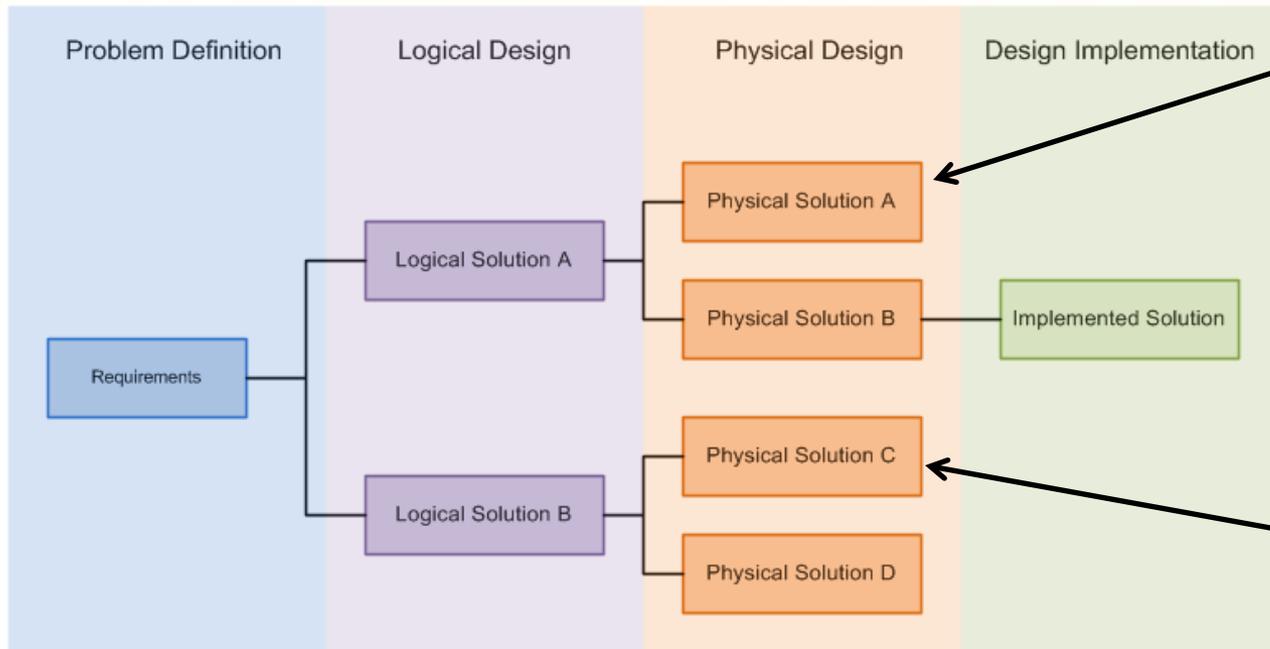
The V-model of development leaves the solution space open, allowing for innovations in the form of solutions.



General Specific

# Risk and Opportunity Awareness

The systems engineering process identifies innovations that could improve the utility of a solution ...



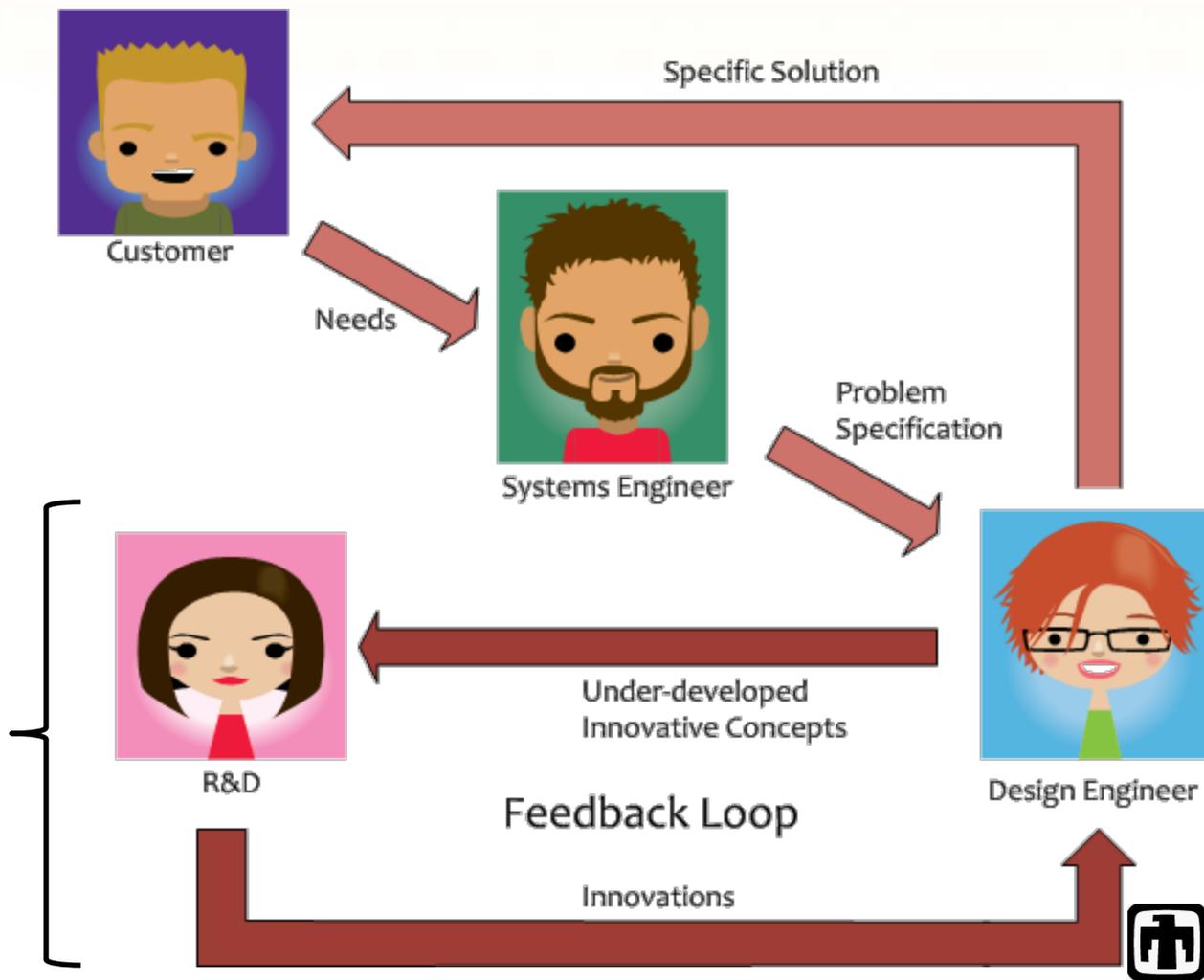
Solution A may have a higher utility than Solution B if a technological leap were made

Solution C may have higher economic risk but significantly higher performance payout

... because you don't want to waste resources on solutions that won't help your business

# Enabling Focused Innovation

The systems engineering *process* enables a business structure that identifies, develops and uses innovations

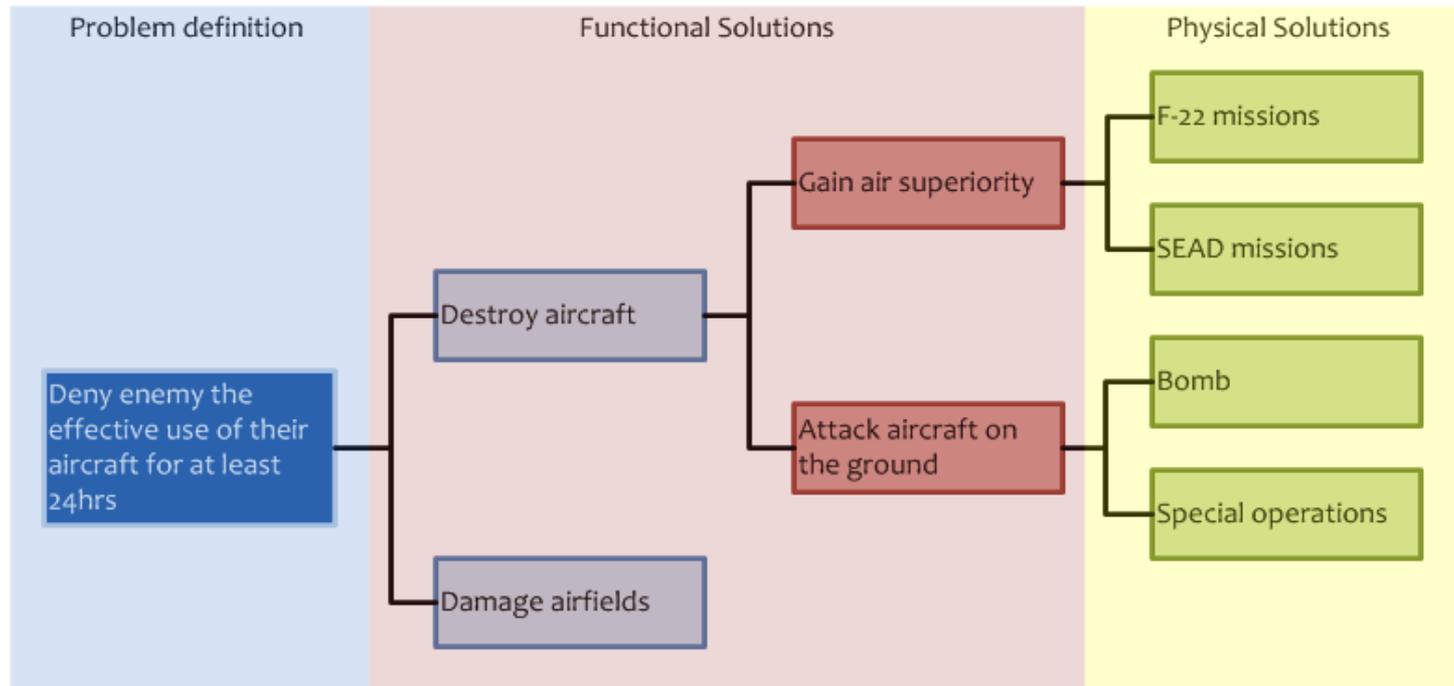


The feedback loop exists because SE focuses innovations on specific applications

# Roadmapping

Not all innovation stems from problem solving during product development ...

Finding areas of innovation at a high level operates the same way using the Vee model



Commonly called “Capabilities-Based Assessment”

See “Capabilities Based Assessment User Guide” from

<https://dap.dau.mil/Pages/Default.aspx>

# Final Words

- This has been a very brief introduction to using system engineering to develop new innovations
- Note that a lot of detail has been neglected
  - Specifically: The “how” of implementing system engineering and achieving assured designs

## QUESTIONS?