

PROJECT LEAD THE WAY

**PLTW**

## **A Design Process**

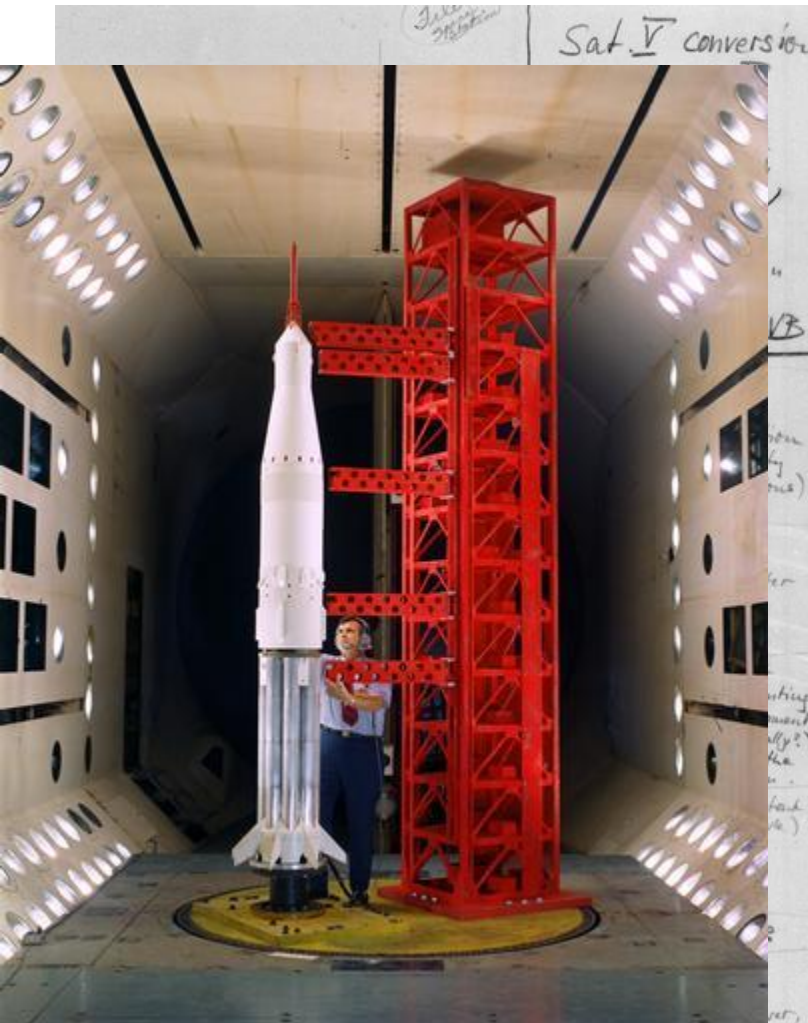
# What Is Design?

The word “*design*” is often used as a generic term that refers to anything that was made by a conscious human effort.



*Design* is also a process that is used to systematically solve problems.

# What Is a Design Process?



A *design process* is a systematic problem-solving strategy, with criteria and constraints, used to develop many possible solutions to solve or satisfy human needs or wants and to narrow down the possible solutions to one final choice.

– ITEA *Standards for Technological Literacy*

water unit.  
cooking  
food storage,  
microwave, etc etc

Oxygen tank  
being used  
for confined  
oxygen storage

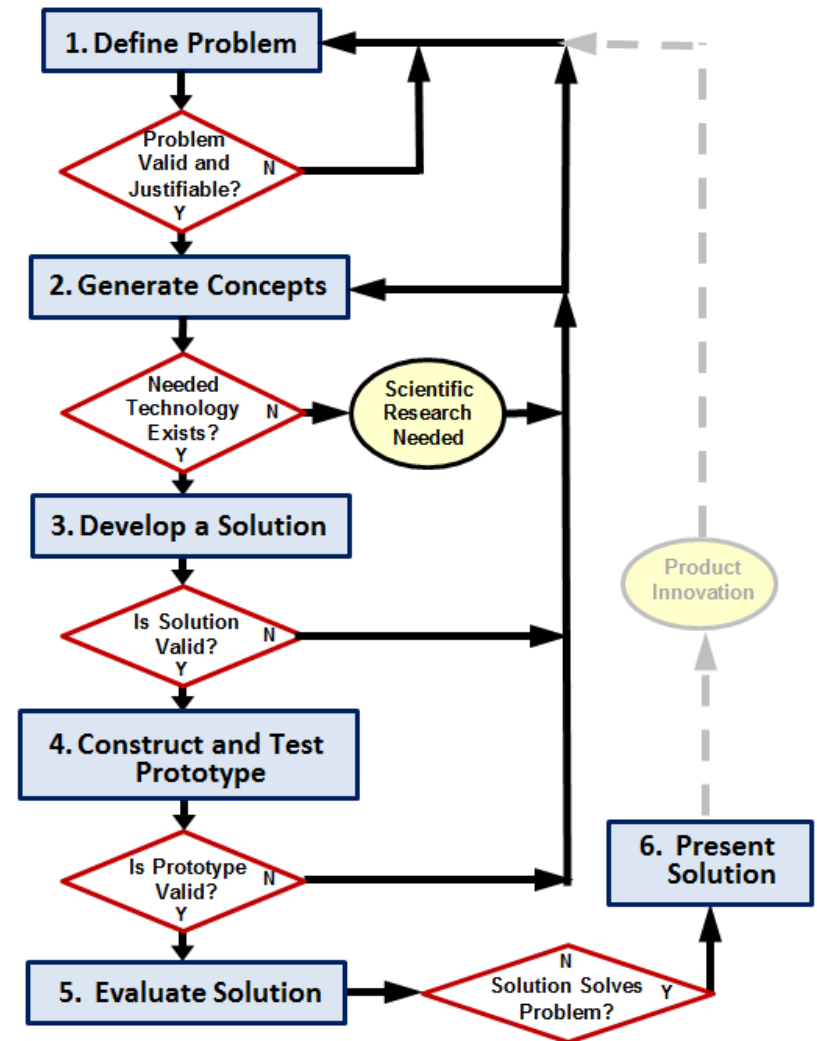
Cooking  
unit

even if station is not  
altitude = stabilized.

Images courtesy of NASA

# Design Process

1. Define the Problem
2. Generate Concepts
3. Develop a Solution
4. Construct and Test a Prototype
5. Evaluate the Solution
6. Present the Solution



*This design process was developed based on the University of Maryland - College Park - IRB Research Project*

# Define the Problem

## 1. Define Problem

- Identify a problem
- Validate the problem
  - *Who says it is a problem?*
  - *Needs and wants*
  - *Prior solutions*
- Justify the problem
  - *Is the problem worth solving?*
- Create design requirements (specifications)
  - *Criteria and constraints*
- *Design Brief*

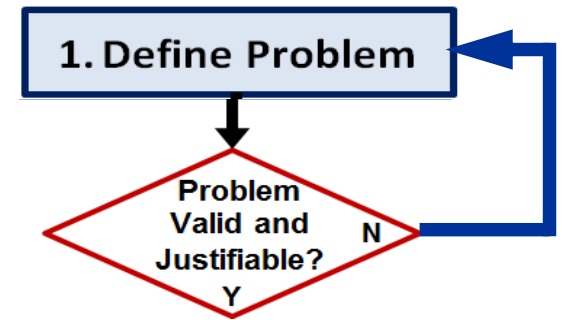
# Define the Problem

## 1. Define Problem

- *Design Brief*
  - *A written plan that identifies a problem to be solved, its criteria, and its constraints.*
  - *Used to encourage thinking of all aspects of a problem before attempting a solution.*

# Define the Problem

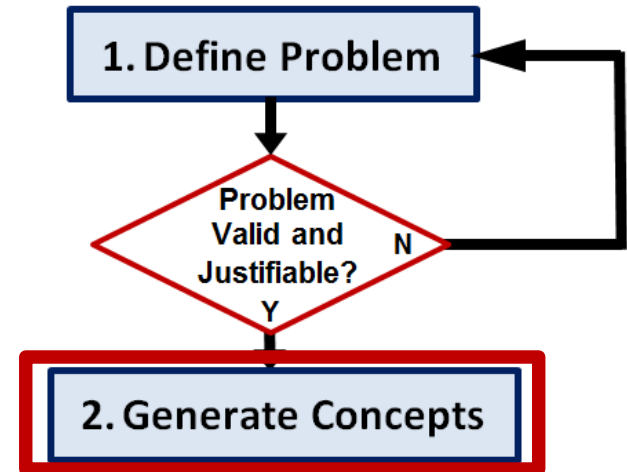
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- Justify the problem
  - *Is the problem worth solving?*
- Create design requirements (specifications)
  - *Criteria and constraints*
- *Design Brief*



In some cases, if the problem is not valid or justifiable, the designer must define a new problem.

# Generate Concepts

- Research
- **Brainstorm** possible solutions
- Consider additional design goals
- Apply STEM principles
- Select an approach
- *Decision Matrix*





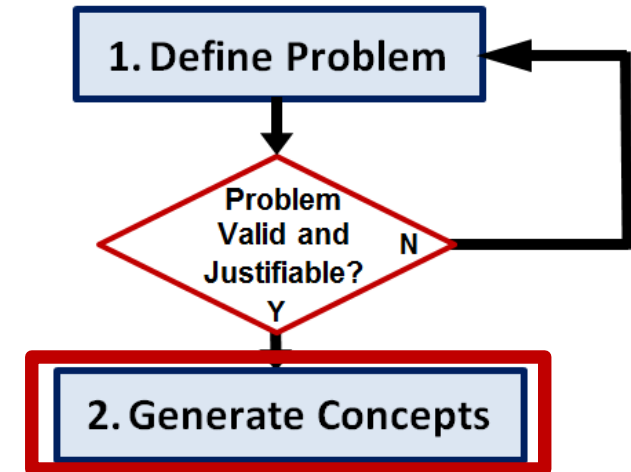
# Generate Concepts

- *Decision Matrix*

- A tool used to compare design solutions against one another, using specific criteria.

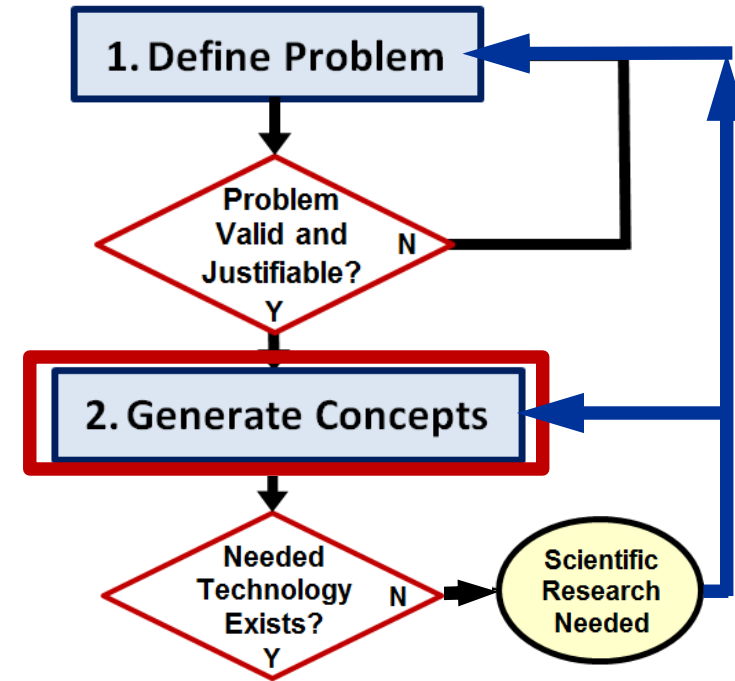
	cost	complexity	Development Time	Total
Idea #1	3	2	1	6
Idea #2	1	1	2	4
Idea #3	4	2	4	10
Idea #4	2	3	4	9
Idea #5	4	1	3	8
Idea #6	3	4	4	11

4	3	2	1	2	1
Best			Worst	Yes	No



# Generate Concepts

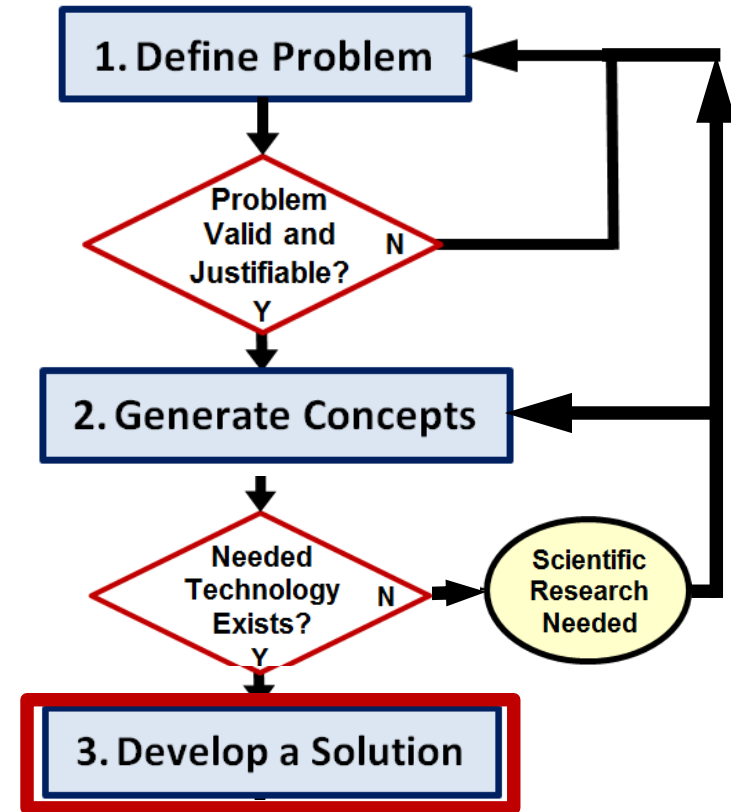
- Research
- Brainstorm possible solutions
- Consider additional design goals
- Apply STEM principles
- Select an approach
- *Decision Matrix*



If the technology necessary to develop the solution does not exist, scientific research may be necessary to pursue a solution.

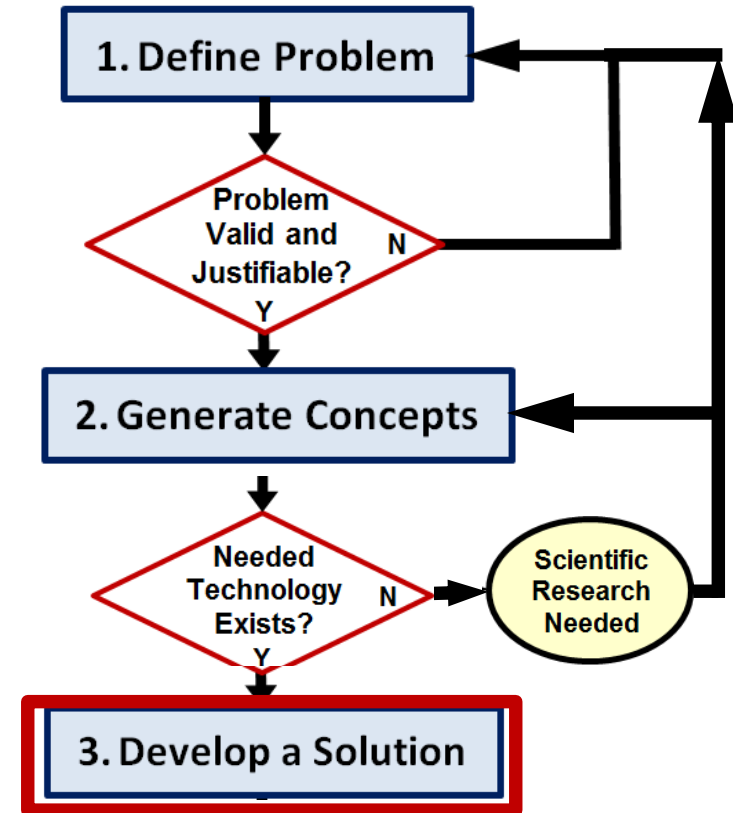
# Develop a Solution

- Create detailed design solution
- Justify the solution path
- *Technical Drawings*



# Develop a Solution

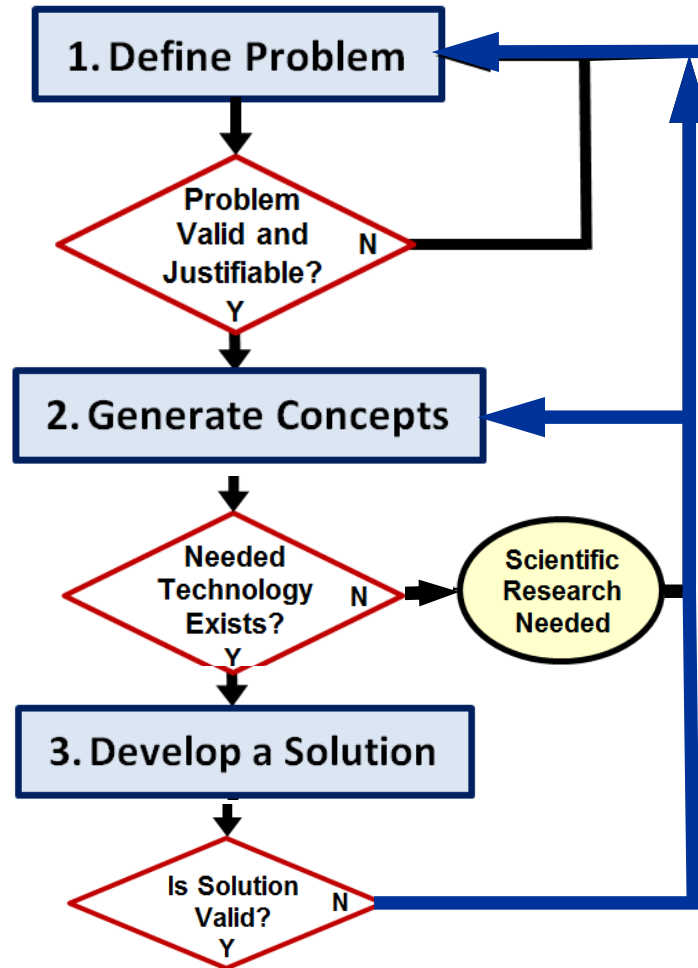
- *Technical Drawings*
  - Drawings that provide technical information necessary to produce a product.
    - material, size, shape
    - assembly, if necessary



# Develop a Solution

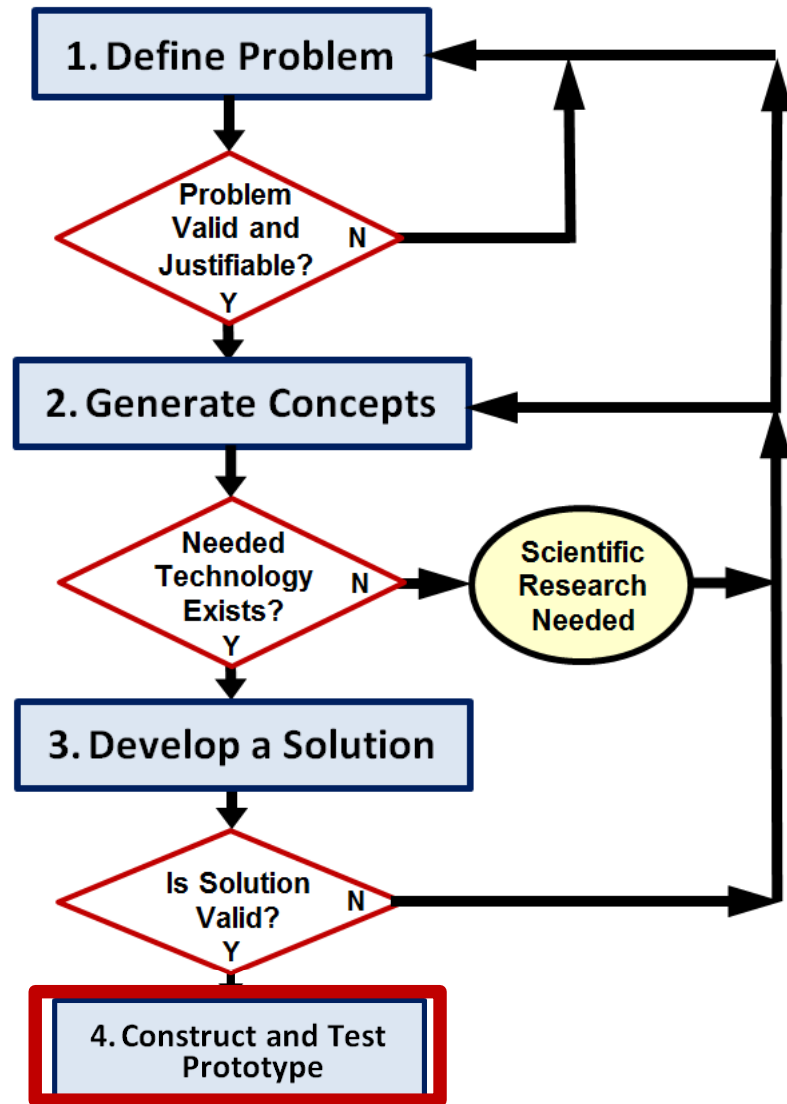
- Select an approach
  - *Decision Matrix*
- Create detailed design solution
  - *Technical Drawings*
- Justify the solution path

If a solution is found to be invalid or cannot be justified, the designer must return to a previous step in the design process.



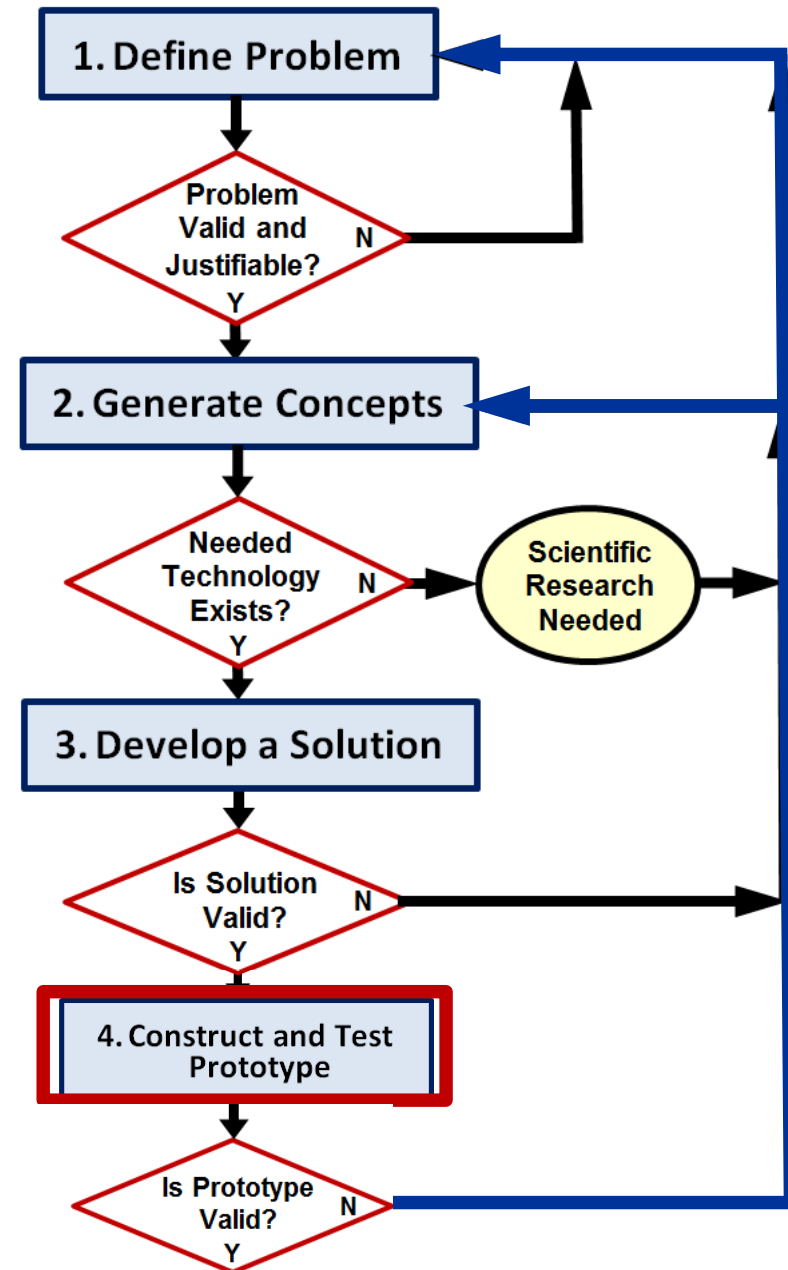
# Construct and Test a Prototype

- Construct a testable prototype
- Plan prototype testing
  - *Performance*
  - *Usability*
  - *Durability*
- Test prototype
  - collect test data
  - analyze test data
- *Test Report*



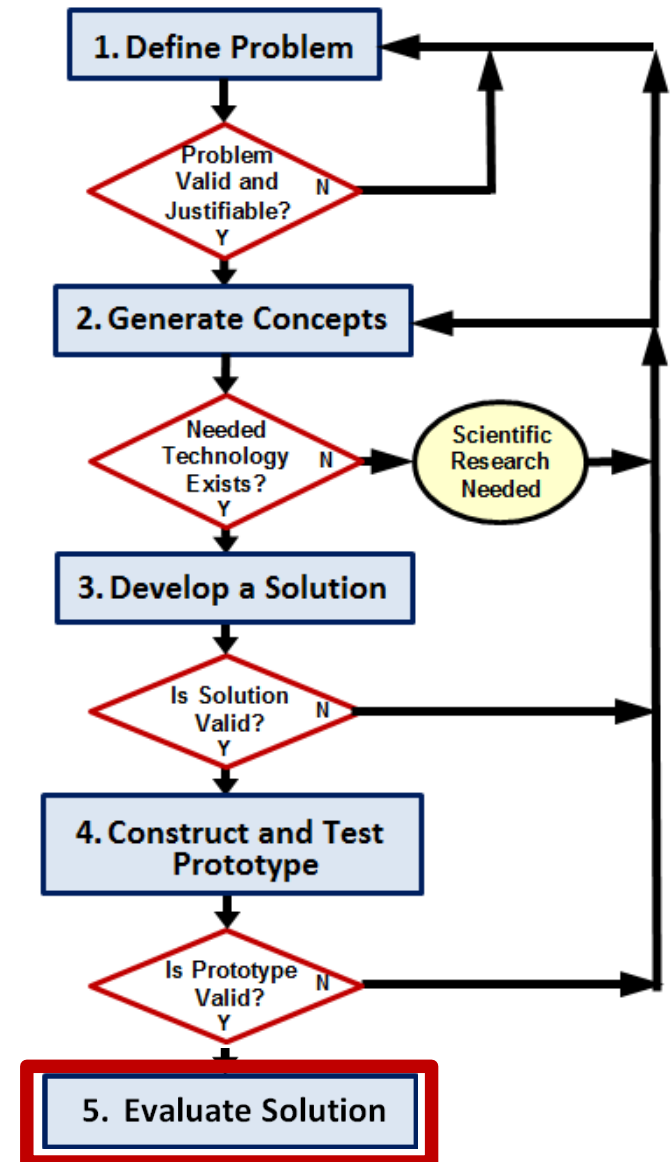
# Construct and Test a Prototype

- Construct a testable prototype
- Plan prototype testing
  - *Performance*
  - *Usability*
- If a testable prototype cannot be built or test data analysis indicates a flawed design, the designer must return to a previous step of the design process.



# Evaluate the Solution

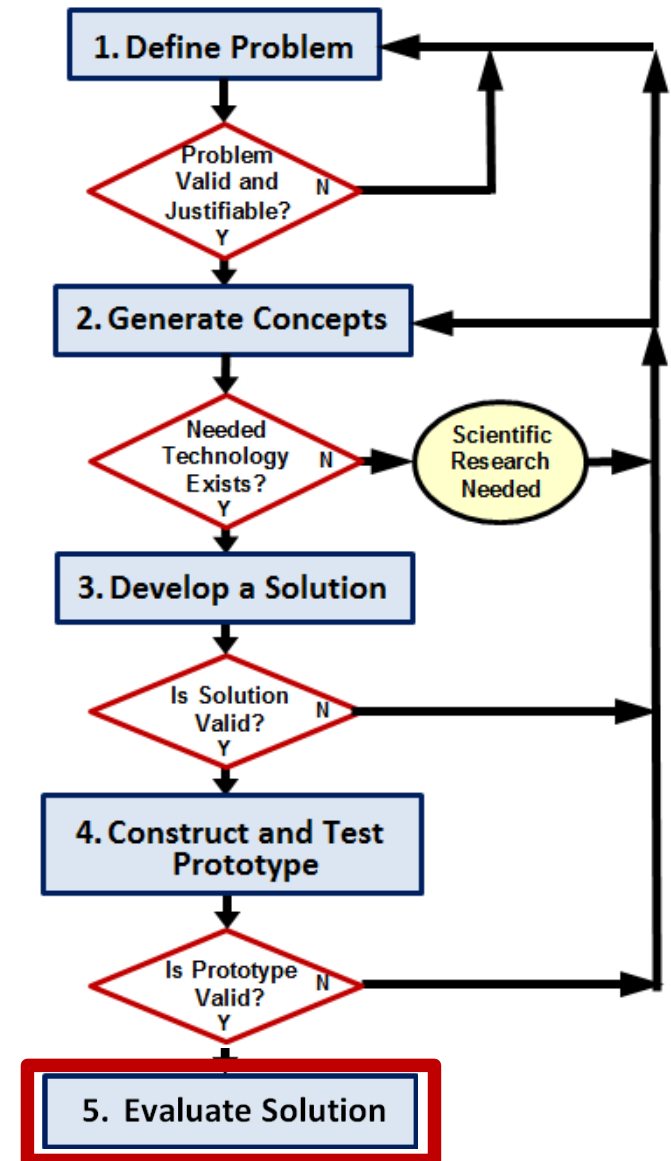
- Evaluate solution effectiveness
- Reflect on design
  - *Recommend improvements*
- Optimize/Redesign the solution
  - *[Return to prior design process steps, if necessary]*
  - *Revise design documents*
- ***Project Recommendations***



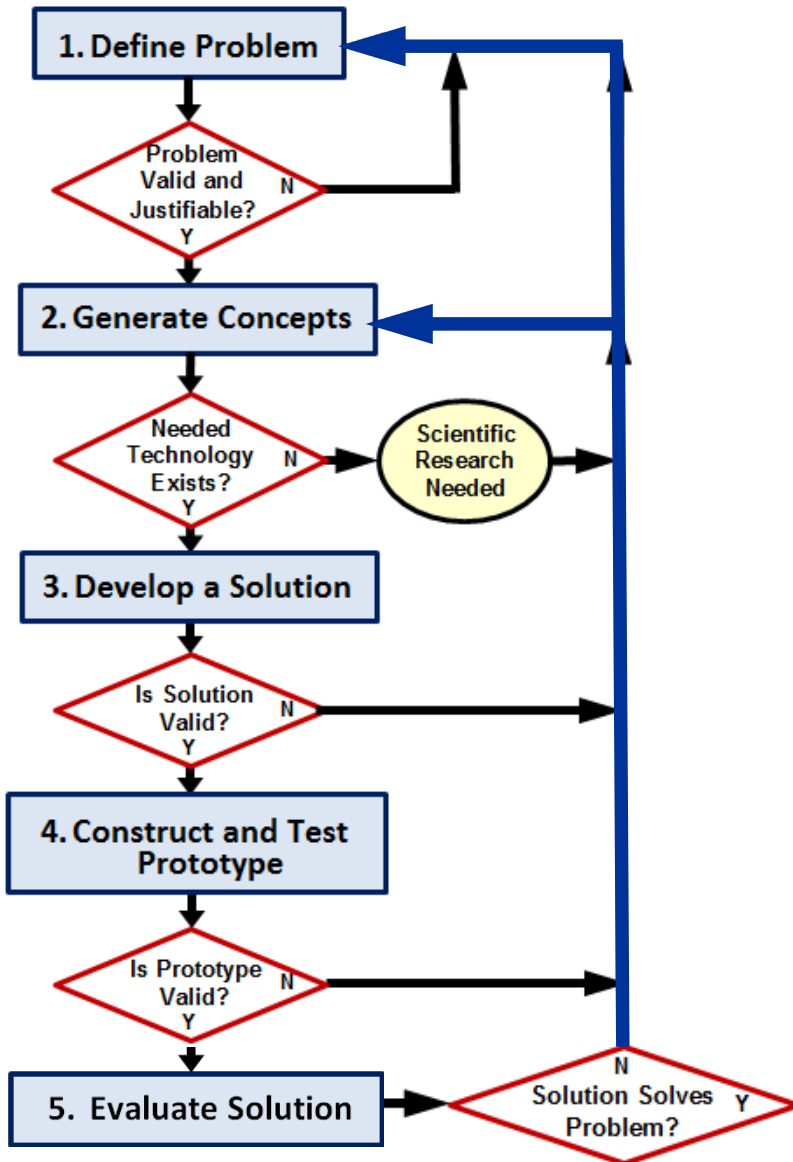


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# Evaluate the Solution

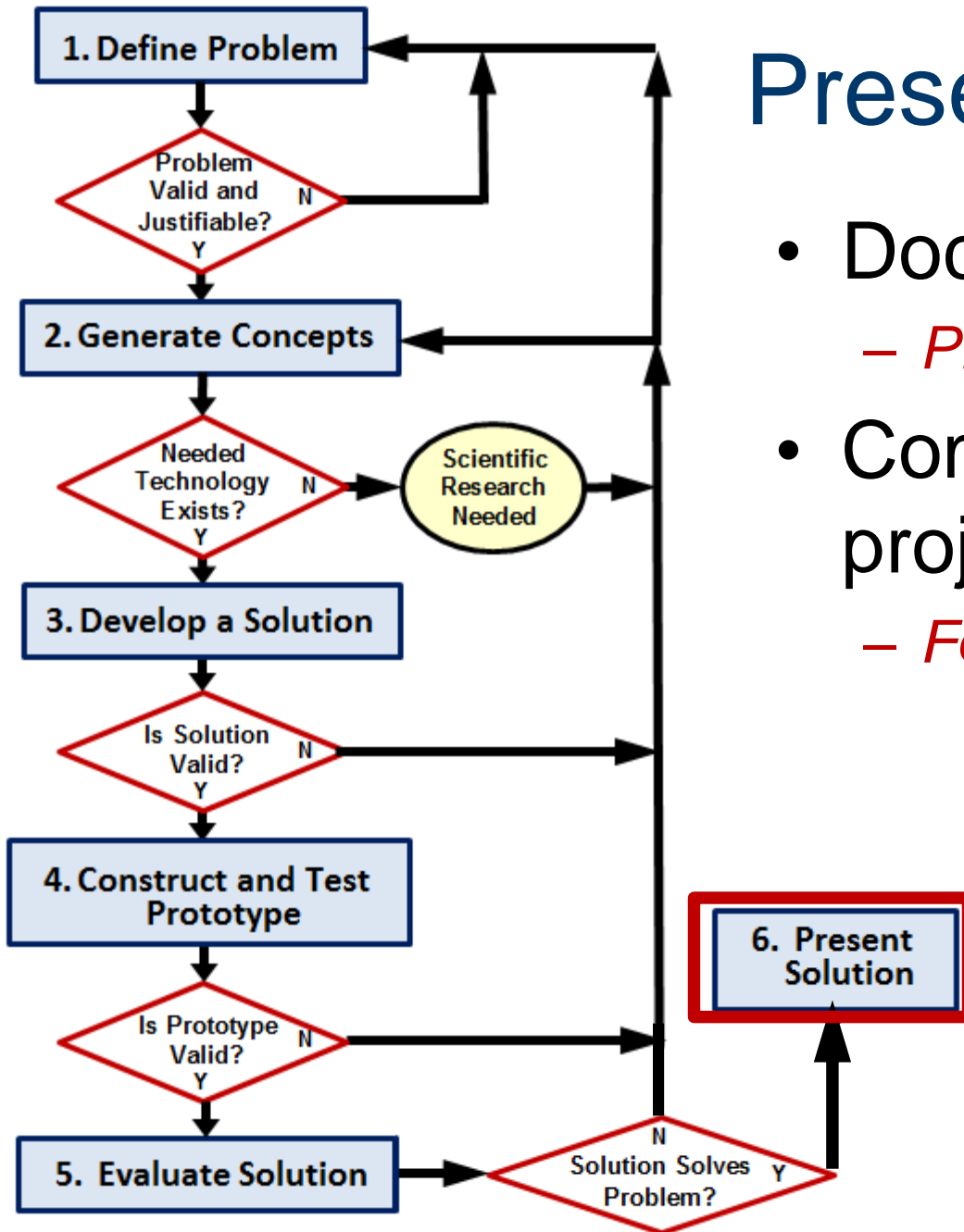


Does the solution solve the problem?

If not, the designer must return to a previous step of the design process.

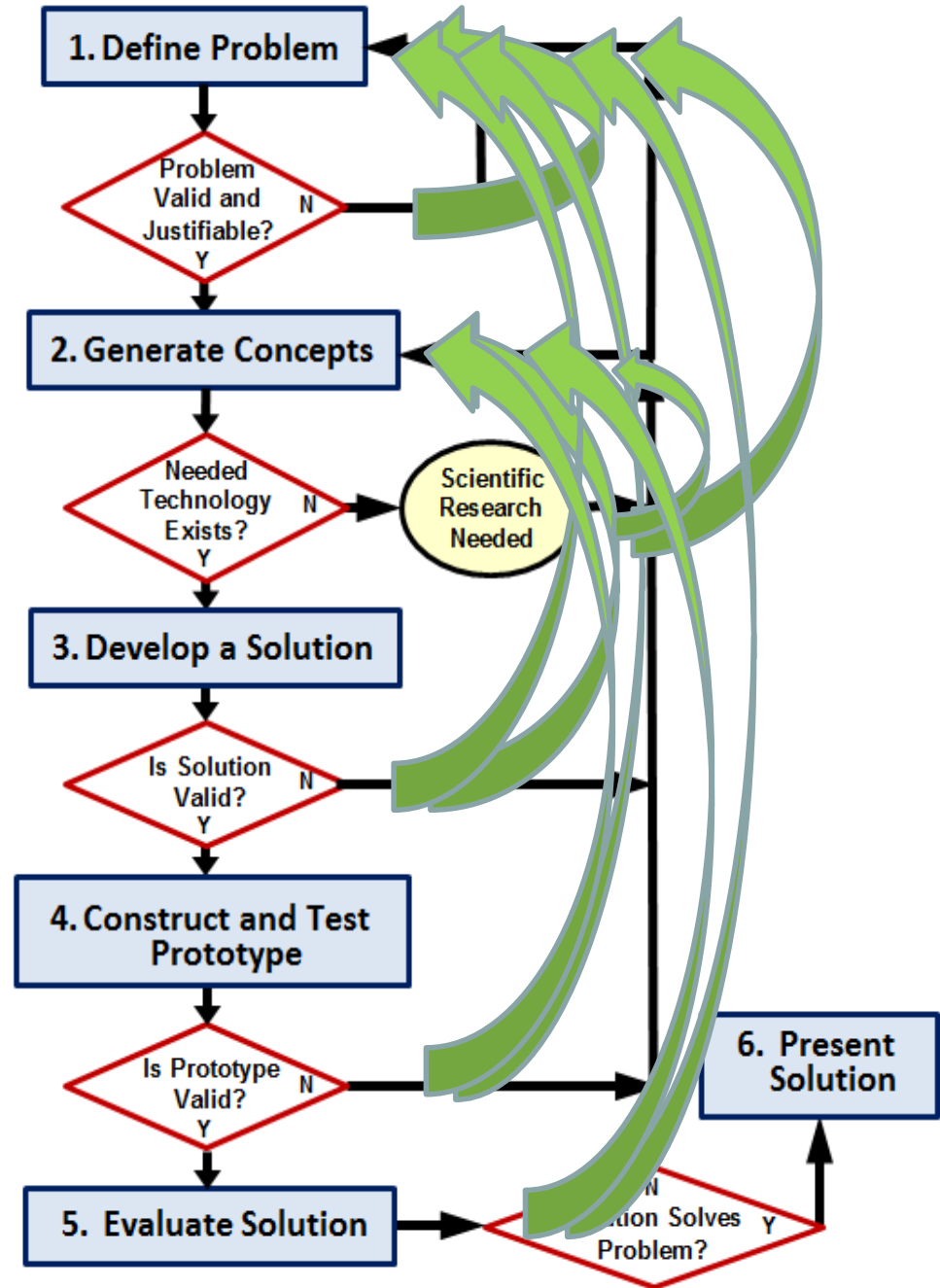
# Present the Solution

- Document the project
  - *Project Portfolio*
- Communicate the project
  - *Formal Presentation*

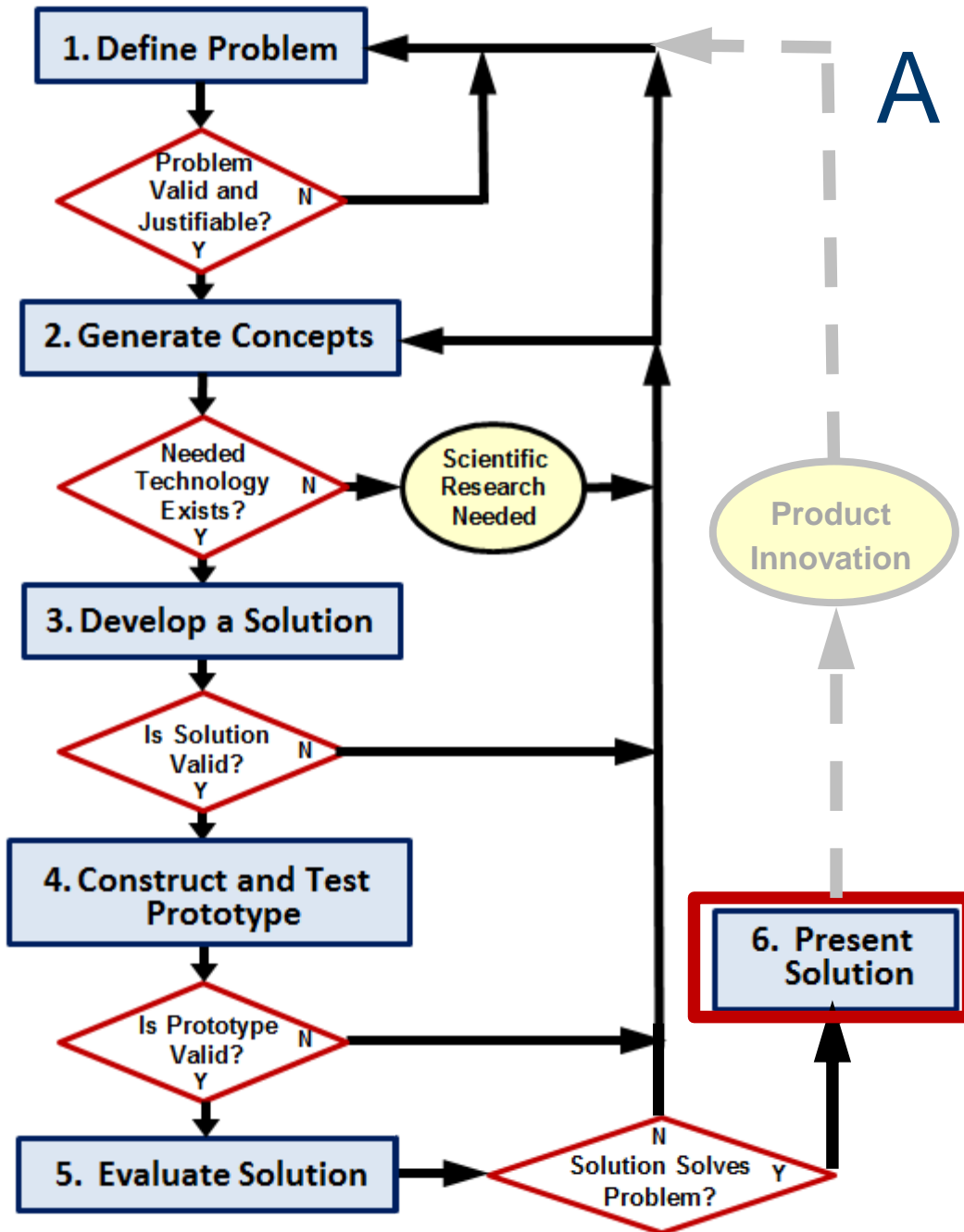


# Design Process

- Iterative



# A Design Process



Product improvement or redesign will require the designer to repeat the design process.

# Image Resources

National Aeronautics and Space Administration (NASA). (n.d.).  
*NASA image exchange*. Retrieved from <http://nix.nasa.gov/>.