



Special Delivery



PACIFIC  
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# Special Delivery

## Design a Vaccine Delivery Solution

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# Our Plan

- Introduce engineering design process
- Introduce our design challenge
- Sketch your design solutions
- Build and test prototypes (iterate!)
- Showcase inventions
- Clean up
- Discussion



# DESIGN PROCESS

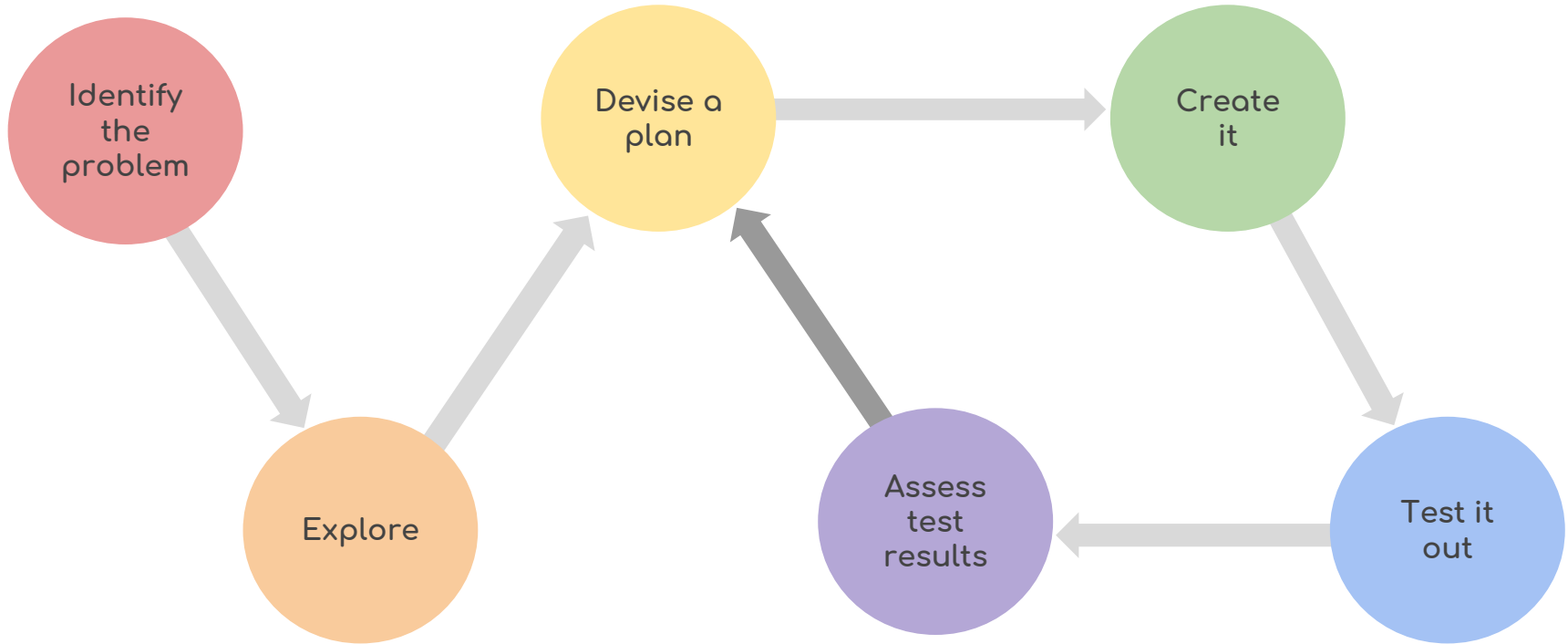


# DESIGN PROCESS

the procedure engineers  
and designers follow to  
create something useful

# DESIGN PROCESS

# DESIGN PROCESS



# Vaccines

“One in five children worldwide are not fully protected with even the most basic vaccines. As a result, an estimated 1.5 million children die each year—one every 20 seconds—from vaccine-preventable diseases such as diarrhea and pneumonia. Tens of thousands of other children suffer from severe or permanently disabling illnesses.



Vaccines are often expensive for the world's poorest countries, and supply shortages and a lack of trained health workers are challenges as well. Unreliable transportation systems and storage facilities also make it difficult to preserve high-quality vaccines that require refrigeration.”

~Bill & Melinda Gates Foundation, Vaccine Delivery Strategy Overview





# Riders for Health



## “Rx for Survival: Delivering the Goods” (55:26 minutes)

This episode shows the difficulty in bringing life-saving technologies and pharmaceuticals to people in geographically challenging rural areas lacking transportation infrastructure. It features the organization Riders for Health that transforms a motorcycle sidecar into an ambulance, which makes for a relevant and inspiring engineering story.

- PBS Rx for Survival website: <https://www.pbs.org/wgbh/rxforsurvival/>
- Video available on YouTube: <https://www.youtube.com/watch?v=756fWV5YTgU>
- **Option:** A clip of the video could be shown starting at 4:15 minutes and ending at 7:25 minutes.
- **Option:** Continue viewing video through 12:04 minutes to include a feature on an infant/child field nurse.
- **Option:** Continue viewing video through 14:04 minutes to show the motorcycle ambulance in action.

## “Vaccine Delivery: The Last Mile” (4:58 minutes)

This Nature video features Riders for Health and their use of motorcycles to transport vaccines to rural areas. This video sets up the barriers to vaccine delivery that present design/logistical challenges.

<https://www.youtube.com/watch?v=3V7V8RCSxQ>

# Design Problem

Many international aid workers struggle to deliver necessary vaccines to remote areas for various reasons, including rough terrain between medical facilities and villages and towns.



# Design Problem

The design challenge: How can a vehicle be designed so that it can travel rough terrain and safely deliver vaccine vials while meeting specific design criteria and constraints?

You will use K'nex and other building materials to construct your model vehicle, which must be capable of safely carrying a container filled with "vaccines" from one end of a track to the other without spilling any contents. To simulate a vehicle driving between two destinations, your model will be pulled at a constant rate by a winch and attached to the winch by way of a small binder clip.



# Success Criteria

How will we know that we are successful  
with our designs?



# Sketch Your Solution

**Individually:** Sketch out your ideas. What materials do you need?

**As a group:** Discuss your ideas. Combine them! Make a new sketch together.

**Start building:** Test often and iterate on your design.

- Your vehicle must be able to carry a film canister.
- Bartering for materials between groups is allowed.
- Test on the track using an empty film canister.



# Invention Showcase

- What are the main features of your design?
- What changes did you make as you iterated on your design?
- How did it perform?
- What changes would you make if you had more time?



# Clean Up Time!



# Discussion Questions

- What element of your vehicle design worked particularly well?
- What were the weaknesses of your design? What would you change about your vehicle if you had more time or different materials?
- Which criteria and constraints did you find most challenging?
- Describe a challenge you encountered and how you iterated on your design to navigate the obstacle.
- What sort of terrain or obstacles might one encounter when delivering vaccines to remote destinations?
- What are some other ways vaccines could be delivered to remote villages?
- Think about the people who might be involved in transporting vaccines or other medical supplies to remote destinations. What type of jobs might be involved in this work?





# Lesson Extension: Cold Chain Design Challenge

- Design a delivery container for vaccines that can keep the vials cold during transport.
- Choose from a range of insulation materials (e.g., foam, felt, bubble wrap, etc.)
- Place an ice cube in the container and place under stage light or heat lamp.
- How long does it take for the ice cube to completely melt?



