



The HTHCV “Backwards Planner” for Projects

How to use this Planner:

Use this as a tool for planning your project. Use the sections that are useful, skip the sections that aren't.

Make sure **you** are in control of the planner, not the other way around!

Part 1: Start with your purpose and your product

1. PURPOSE & ENGAGEMENT

Why does this project matter? Why will your kids care? What will make them excited to come to school every day to tackle this project?

2. ESSENTIAL QUESTION(S)

What big, important, interesting questions will your project seek to answer?

3. YOUR PRODUCT

What do you want students to *do*, *write*, *create*, or *build*?

Envision the final product. What elements would we see in a truly quality final product?

Where will your project “live” after the exhibition ends? How can you avoid this becoming a “dumpster project”?

3. YOUR LEARNING GOALS

What do students need to know in order to do a good job on this project? How can they learn it? When will they need to know it?

What	How	When

What skills will students develop as they work toward creating this product?

SKILLS	WHERE WE WILL SEE EVIDENCE OF THIS SKILL

What academic content do you want students to learn?

--

BACKWARDS PLANNER

Part 2: Scaffolding for Work of Excellence

If the goal is a **truly quality final product**, what are the **indispensable steps** in the process that you need to plan for intentionally? *Prototyping? Drafting? Critique? Refinement? Rehearsal?*

MILESTONES - What are the important milestones along the way to the final draft? Think about:

- DELIVERABLES: deadlines for drafts and specific product components
- CRITIQUE: opportunities to receive meaningful feedback (from you, from peers, from an outside audience, from an adult expert)
- REFLECTION: regular opportunities to reflect on and document their progress

Week	Activities	Deliverables
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

(Of course, use more paper if your project lasts longer than 10 weeks!)

BACKWARDS PLANNER

Part 3: Scaffolding for Rich Learning Along the Way

LEARNING FROM MODELS

What models of excellent work can students study to inspire their own work of excellence? (Models created by professionals? by you? by past students?)

LEARNING FROM ADULTS IN THE COMMUNITY

What adult professionals could you bring in as guest speakers or to give feedback during critique?

What field experiences could you design for the students? Other opportunities for adult-world connection?

LEARNING FROM TEXTS

What texts will students read and discuss to enrich their learning along the way?

LEARNING FROM GROUP WORK

How will group work be structured? How will tasks be delegated to support every member of the group's active engagement in the project work?

How can students take on "professional roles/responsibilities" (e.g. project manager, documentarian, etc.) throughout the project? How else can you scaffold the process to give students a chance to step into the shoes of adult professionals?

BACKWARDS PLANNER
Part 4: Designing for Literacy

	Grounding Text	Professional Text	Relational Text	Experience as text
What do you want students to get from this text?				
What academic vocabulary or themes do students need?				
How will you structure and scaffold the learning?				
How will you assess the learning?				
What is the connection to the product?				

--	--	--	--	--

<p>Grounding Text</p>	<p>A grounding text is an anchor text that the project is centered around. This text should be one that can be deconstructed for deeper meaning and learning. This text should be a 'rigorous' and 'grade-level' text that students will enjoy discussing multiple times throughout a project.</p>
<p>Professional Text</p>	<p>A professional text is one that students would interact with if they were in the professional world of the project you complete. This text may be one that is used to introduce research methods or the latest research. These texts are often written by experts and require a great deal of scaffolding for students to access.</p>
<p>Relational Text</p>	<p>The text is a contemporary text that supports the students' understanding of how this work impacts their daily life. This piece should be one that is relevant, timely and purposeful to the concepts, skills or products developed within the project.</p>
<p>Experience as text</p>	<p>This text is one that should be written or constructed by students based on field experiences, experiments, etc. This could take the form of a transcript from an interview, a reflection on a trip, a vlog, photographic story, or any other form of documentation. The idea is to help students have a significant learning experience they can link their learning to within the project.</p>

Four types of texts in projects

MODEL BACKWARDS PLANNER: KARA QUINLAN, 9TH GRADE PHYSICS

PLANNING BACKWARDS (*Part 1*): Start with your purpose and your product

1. PURPOSE & ENGAGEMENT

Why does this project matter? Why will your kids care? What will make them excited to come to school every day to tackle this project?

Mars is the new frontier. The current 9th grade-12th grade classes will be the age group of new astronauts for selection for the upcoming manned-mission to Mars. Mars will need astronauts who are involved in numerous fields of study. Students will be able to specialize in calculations, vehicle design, communication, or humanity aspects of space travel.

2. YOUR PRODUCT

What do you want students to *do, write, create, or build*?

The project will take the students through the engineering aspects of rocket design as well as the history of NASA. We will also be looking into to the future of Mars research and current events. Students will design multiple rockets and calculate the fundamental aspects of rocketry flight, trajectory and forces. Students will have different design criteria for their rockets such as: maximum altitude, maximum flight time, maximum payload and quickest relaunch. They will complete test flights without a payload, with half a payload and full payload. The body of the rockets will be made from reusable and common household materials such as toilet paper tubes, paper towel tubes, cardboard boxes.

Envision the final product. What elements would we see in a truly quality final product?

The project will take the students through the engineering aspects of rocket design as well as the history of NASA. A quality product is a rocket that flies true and accomplishes the mission designed for the rocket. Rockets ideally will go through a total of three flights with critique sessions after each launch. The data will

We will also be looking into to the future of Mars research and current events.

The concepts behind NASA's rocketry projects will assist in stoking the fires of students curiosity and interests in STEM careers and space exploration.

During the Colonize Mars project students will learn about engineering failures that led to rocketry success. The project will further explore trigonometry, Newtonian physics, physics of flight, force vectors, and key historical events.

Students will also be reading *The Martian* as well as studying the latest in science from NASA and Mars.

The only supply the students are missing are the engines!

Where will your project “live” after the exhibition ends? How can you avoid this becoming a “dumpster project”?

At the moment this is undecided. We spoke about converting the 9th grade garden space into a Mars-scape. The parts of the process would be exhibited outside to map their work and thought process for Colonizing Mars. There will be a community launch night to showcase their rockets aside from FDS night.

3. YOUR LEARNING GOALS

What do students need to know in order to do a good job on this project? How can they learn it? When will they need to know it?

What	How	When
Engineering Failures	Activities, lessons, reading	Week 1
Trigonometry	Application, models, practice	Week 1-3
Newton's Laws	Application, models, practice	Week 2-4
Force Vectors	Application, models, practice	Week 3-8
Rocket Design	Design, critique, application, building	Week 3-11
History of Rockets/ Practical Field Experience	Readings, videos, articles	Week 3-11

What skills will students develop as they work toward creating this product?

SKILLS	WHERE WE WILL SEE EVIDENCE OF THIS SKILL
Rocket Assembly	Rocket flies and recovers correctly
Craftsmanship	The rocket achieves the design criteria and building rockets
Trigonometry	Rocket altitude calculated
Problem Solving/ Analytical Skills	Trouble-shooting technical problems with Drones
Website Construction	Team Weebly websites that documents the process, technical specs, daily work, blogs about the process

What academic content do you want students to learn along the way?

Students will learn about:

- Learn trigonometry, acceleration, velocity and projectile motion and application of real world vectors
- Apply Bernoulli's equations of lift for optimizing rocket flight
- Wernher Von Braun
- Sputnik
- Mercury Missions
- NASA
- SpaceX
- Apollo Missions
- Shuttle Missions, Challenger & Discovery
- Reading *The Martian*: connections to science in literacy

PLANNING BACKWARDS (*Part 2*): Scaffolding for Work of Excellence

If the goal is a **truly quality final product**, what are the **indispensable steps** in the process that you need to plan for intentionally? *Prototyping? Drafting? Critique? Refinement? Rehearsal?*

There will be an initial rocket design, launch and data analysis for the first design. After their initial design students will decide if their rocket's mission is:

- Maximum altitude
- Maximum flight time
- Maximum payload

Based on their knowledge of rockets they will create multiple versions after the initial flight.

MILESTONES - What are the important milestones along the way to the final draft? Think about:

- **DELIVERABLES:** deadlines for drafts and specific product components
- **CRITIQUE:** opportunities to receive meaningful feedback (from you, from peers, from an outside audience, from an adult expert)
- **REFLECTION:** regular opportunities to reflect on and document their progress

Week	Activities	Deliverables
Jan. 2nd	Engineering Disasters, Werhner von Braun	Discussion on WVB
Jan. 9th	Trig, and Newton's Laws, Stage 1 Rockets	Trig SOHCAHTOA, Application of simulated rocket launches with Newton's Law, begin assembly of common design of rocket
Jan. 17th	Trig, Newton's Laws, applications to Space	Build common design, launch initial flights
Jan. 23rd	Build 1st prototype, launch, calculations	Begin engineering design of custom rocket, field trip to Fleet museum, Hidden Figures Movies, pivotal characters in history socratic seminar
Jan. 30th	Critiques, redesign, Newton's Laws	Launch custom rocket, compare/ contrast to common design. Calculations due
Feb. 6th	Physics of flight, 2nd Launch	
Feb. 13th	Analysis, calibration	
Feb. 21st	Science of Space	
Feb. 27th	3rd Flight, calculations	
Mar. 6th	Flight Physics	
Mar. 13th	4th Flight, community launch night	

PLANNING BACKWARDS (*Part 3*): Scaffolding for Rich Learning Along the Way

LEARNING FROM MODELS

- What models of excellent work can students study to inspire their own work of excellence? (Models created by professionals? by you? by past students?)

We will look at examples from history, NASA, SpaceX and Lockheed Martin.

LEARNING FROM ADULTS IN THE COMMUNITY

- What adult professionals could you bring in as guest speakers or to give feedback during your critique process?

I have contacted SpaceX, the Civil Air Patrol and have connections through the Midway for former Vets who flew or navigated aircraft.

- What field experiences could you design for the students? Other opportunities for adult-world connection?

I contacted the San Diego Air and Space Museum and the Fleet Science Center in Balboa Park for experiences with Be the Astronaut and A Beautiful Planet

LEARNING FROM TEXTS

- What texts will students read and discuss to enrich their learning along the way?

Physics textbooks, *Hidden Figures*, current articles on the legislation for the Manned Mission to Mars, Civil Air Patrol Model Rocketry Second Edition Text for the history of rocketry. Assorted articles from Space.com, NASA and other resources.

LEARNING FROM GROUP WORK

- How will group work be structured? How will tasks be delegated to support every member of the group's active engagement in the project work?

Solving Rocketry problems requires a community of learners. The students will use app.seesaw.me to document, solve and troubleshoot rocketry problems. They will post solutions, questions and answers to content and discuss it together.

- How can students take on "professional roles/responsibilities" (e.g. project manager, documentarian, etc.) throughout the project? How else can you scaffold the process to give students a chance to step into the shoes of adult professionals?

Students will be split into two roles, Rocket Scientist Lead and Aerospace Engineer Lead. The scientist will take the lead calculations and the engineer will take the lead in building the rocket. Both students are expected to assist in both calculations and assembly. Only the lead roles will be responsible for turning in finalized steps.