



VIRTUAL MISSIONS
AND EXOPLANETS

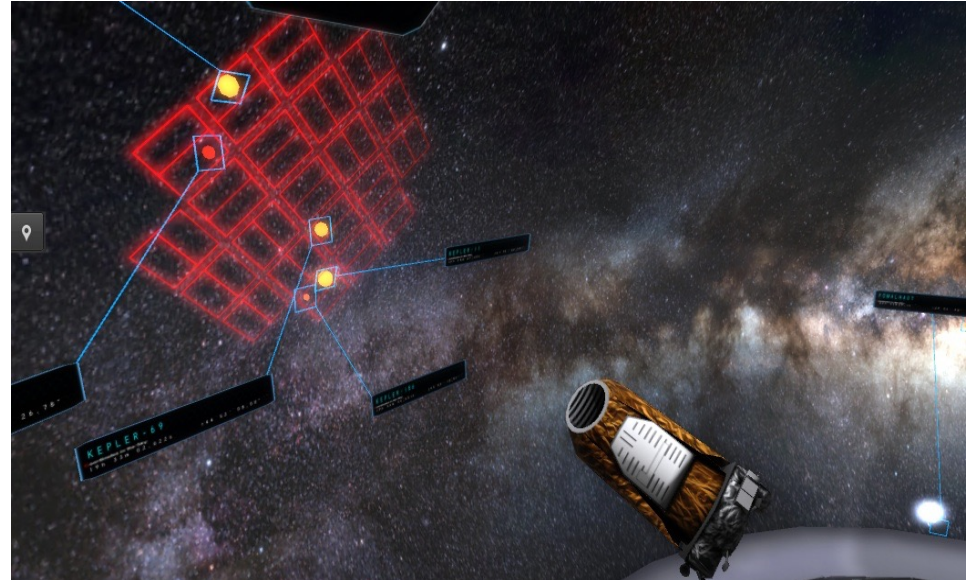
Webinar Series

Part 1: Curriculum Overview



The Exoplanet “Hook”

Is it science fiction or science fact?



Poll:

Do you think we'll find our “Earth twin”?

vMAX Goals

- Increase
 - Student engagement in STEM
 - Knowledge of real exoplanetary systems, missions, and data
 - Awareness of NASA-related careers
- Contribute
 - Exoplanet-related curricular materials to NASA
- Advance
 - Body of knowledge on best use of virtual world technologies

vMAX Summer Camp

What

- One-week summer workshop, 5 days, 6hrs/day (flexible)

Who

- Middle school students

How

- Combination real and virtual world engagement

Benefits of the vMAX Virtual World

FROST
SCIENCE



New York Hall of Science



FROST
SCIENCE

Evaluation

Increasing engagement over the course of the 5 days
It needed a balance of what students most liked:

...debating
and working
in teams



...computer
time



...hands-on
activities



...meeting
experts



And many liked the content.



(How could you not?)



VIRTUAL MISSIONS
AND EXOPLANETS

Curriculum Elements

vMAX Curriculum

[vMAX Overview](#)[Assessments](#)[Day One](#)[Day Two](#)[Day Three](#)[Day Four](#)[Day Five](#)

vMax Educator Implementation Guide

This LiveBinder supports educators as they implement vMax learning experiences for students.



[Details](#)

Table of Contents ⓘ

- [vMAX Overview](#)
 - [The vMAX Project](#)
 - [GETTING STARTED WITH vMAX](#)

- Web-based “LiveBinder”
- Problem-based and design-based learning
- Flexible for varying student needs
- Comprehensive curriculum for five 6-hour days
- Individual elements stand alone as desired

Standards-Based

vMAX Overview

Assessments

Day One

Day Two

Day Three

Day Four

Day Five

The vMAX Project

GETTING STARTED WITH vMAX

MUSEUM COLLABORATION

ESSENTIAL QUESTIONS

STEM ENGAGEMENT

ENGINEERING DESIGN PROCESS

MISSION NOTEBOOK

THE 7E MODEL OF LEARNING

NEXT GENERATION SCIENCE STANDARDS

TECHNOLOGY REQUIREMENTS

MATERIALS LIST

SUPPLEMENTAL SPACE MATH@NASA PROBLEMS

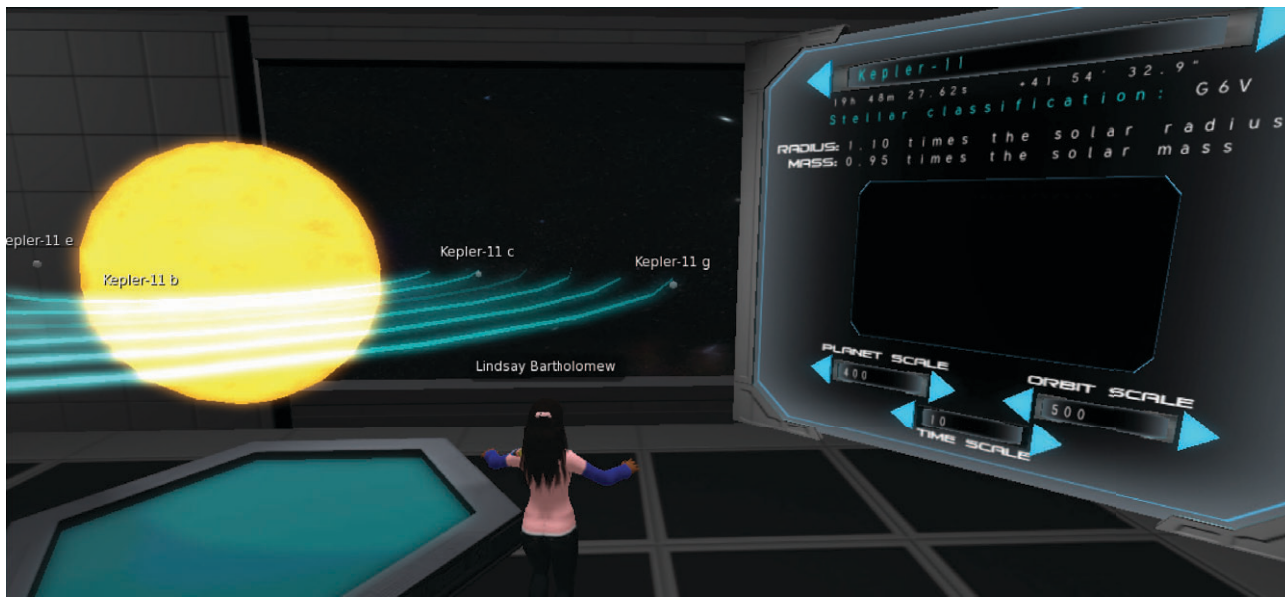
SUPPLEMENTAL VIDEOS, SIMULATIONS, and MODELS

SUPPLEMENTAL ACTIVITIES and WEBSITES

vMAX and the Next Generation Science Standards

MIDDLE SCHOOL STANDARDS

MS-ESS1-1: Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns



Hands-on Activities

vMAX Overview

Assessments

Day One

Day Two

Day Three

Day Four

Day Five

DAILY AGENDA

****TASK 1: ENGAGE AND ELICIT -- SCENARIO AND CHALLENGE BOARD**

****TASK 2: ELABORATE -- DESIGN**

****TASK 3: EXPLORE -- BUILDING IN THE VIRTUAL WORLD**

****TASK 4: EXPLAIN AND EVALUATE -- SHARE DESIGNS**

****TASK 5: ELABORATE -- IMPROVE DESIGNS**

****TASK 6: EXPLAIN AND EVALUATE -- LAUNCH VIRTUAL ROCKETS**

****TASK 7: EXTEND -- ROCKET ACTIVITIES**

TASK 8: EXPLAIN AND EVALUATE -- DEBRIEF

TASK 9: CELEBRATION

****OPTIONAL TASK -- IF STUDENTS HAVE TIME**

Student Live Binder

Balloon Staging

Water Rocket Construction

Water Rocket Launcher Construction



Integrated STEM Learning Experiences

vMAX Overview

Assessments

Day One

Day Two

Day Three

Day Four

Day Five

DAILY AGENDA

****TASK 1: ENGAGE AND ELICIT -- SCENARIO AND CHALLENGE BOARD**

****TASK 2: EXPLORE -- EXOPLANET TEAM RESEARCH**

TASK 3: EXPLAIN -- WHOLE GROUP DEBRIEF

****TASK 4: EXPLORE - DR. SARA SEAGER**

****TASK 5: EXPLAIN AND EXPLORE -- SPECTROSCOPY**

****TASK 6: INDIVIDUAL ACTIVITY: LIFE OR NOT**

****TASK 7: EXPLORE -- VIRTUAL WORLD**

TASK 8: EXPLAIN AND EVALUATE -- TEAM DATA ANALYSIS AND DEBRIEF

Student LiveBinder



Research and Skill Building

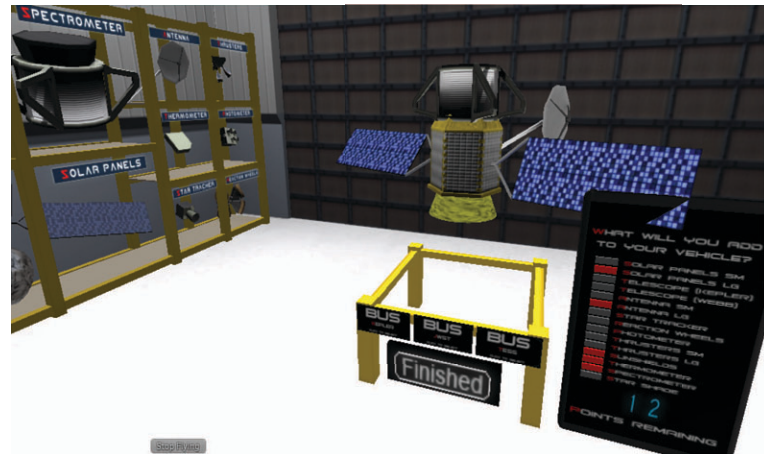
Inquiry



Collaboration

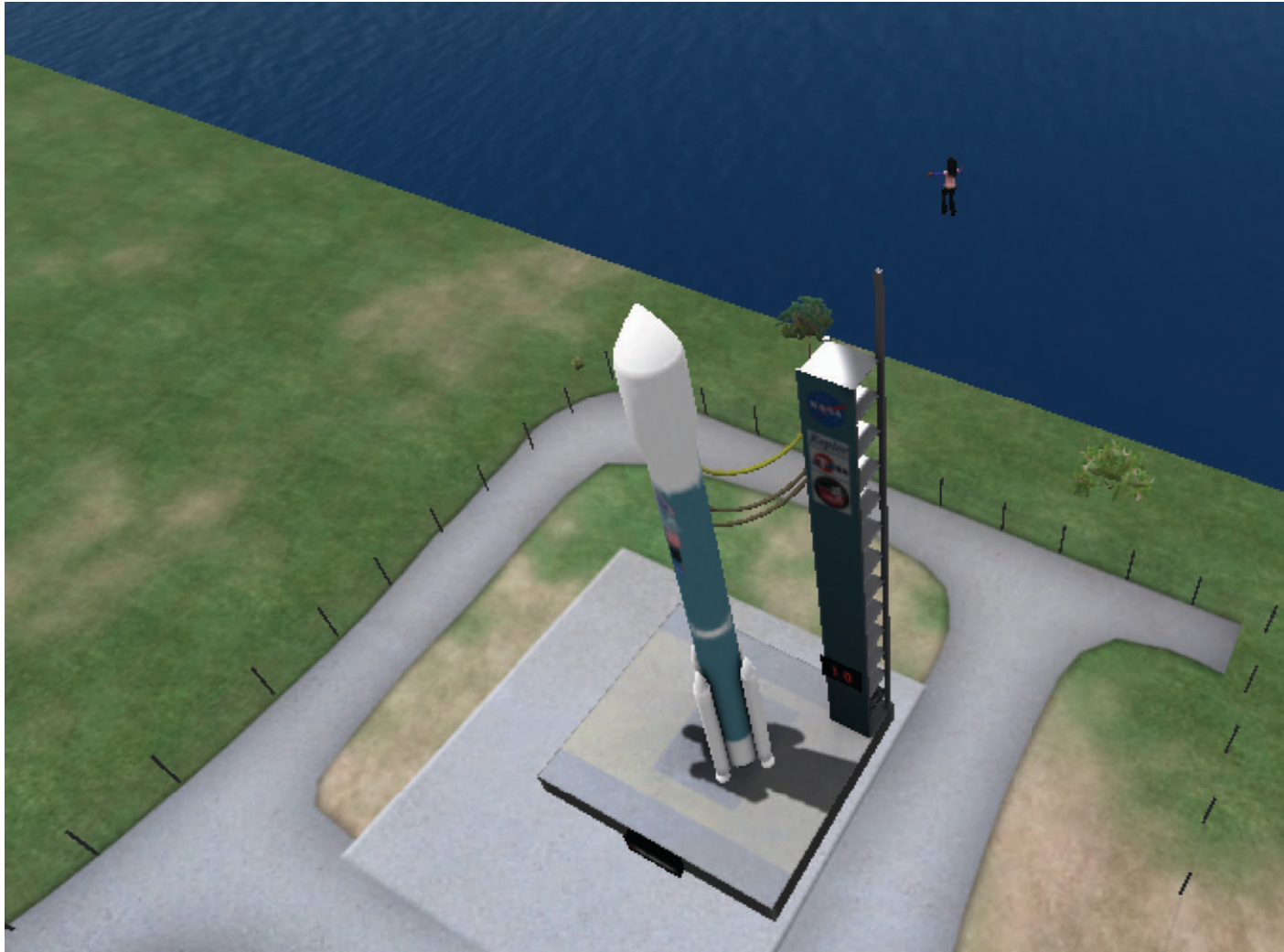


Critical thinking



Creativity

New Technologies

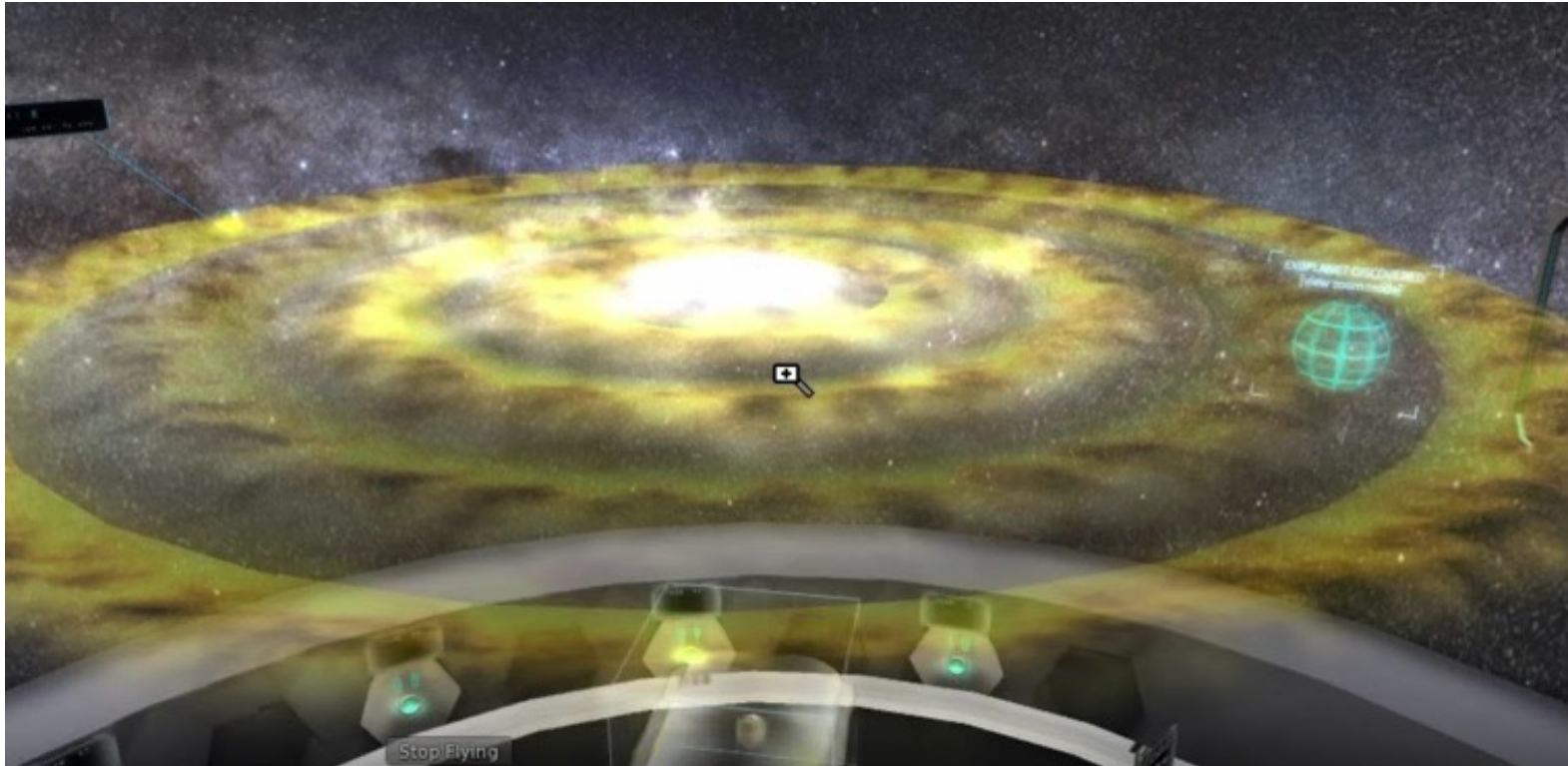


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VIRTUAL MISSIONS
AND EXOPLANETS

Virtual World Tour

Video: Fly-Through of the Virtual World



Video link will be provided at the end of this presentation.



VIRTUAL MISSIONS
AND EXOPLANETS

Curriculum: A Look Inside

The Story of vMAX

vMAX Overview	Assessments	Day One	Day Two	Day Three	Day Four	Day Five
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	NEXT GENERATION SCIENCE STANDARDS	TECHNOLOGY REQUIREMENTS	MATERIALS LIST			
	SUPPLEMENTAL SPACE MATH@NASA PROBLEMS	SUPPLEMENTAL VIDEOS, SIMULATIONS, and MODELS				
		SUPPLEMENTAL ACTIVITIES and WEBSITES				

Day 1: What are exoplanets? Where are they? What are they like?🔗

Day 2: How do we detect exoplanets?🔗

Day 3: How do we learn more about exoplanets once we find them?🔗

Day 4: Is there an exoplanet like Earth? Which one warrants more investigation?🔗

Day 5: What technology is needed to accomplish that? Does it exist? Is it possible?

Collaborations (Museums/Schools/etc)



Essential Questions

What are exoplanets?



Essential Questions

Why should we care about exoplanets?

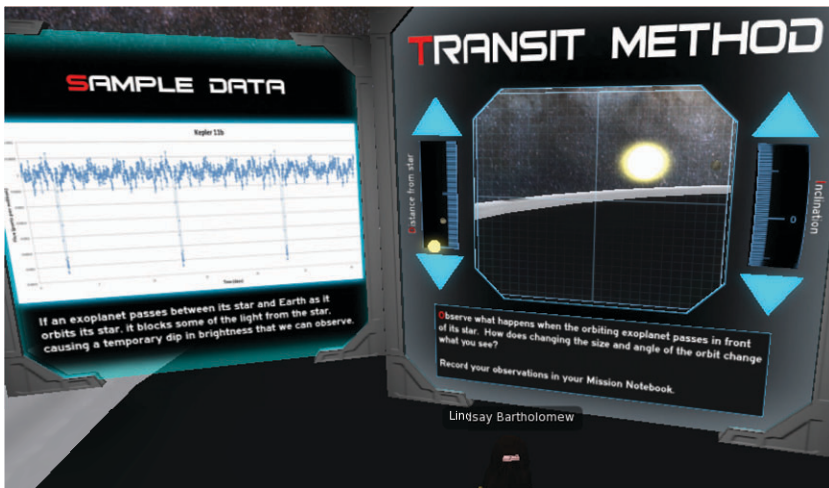


Poll:

Should we continue to search for exoplanets?

Essential Questions

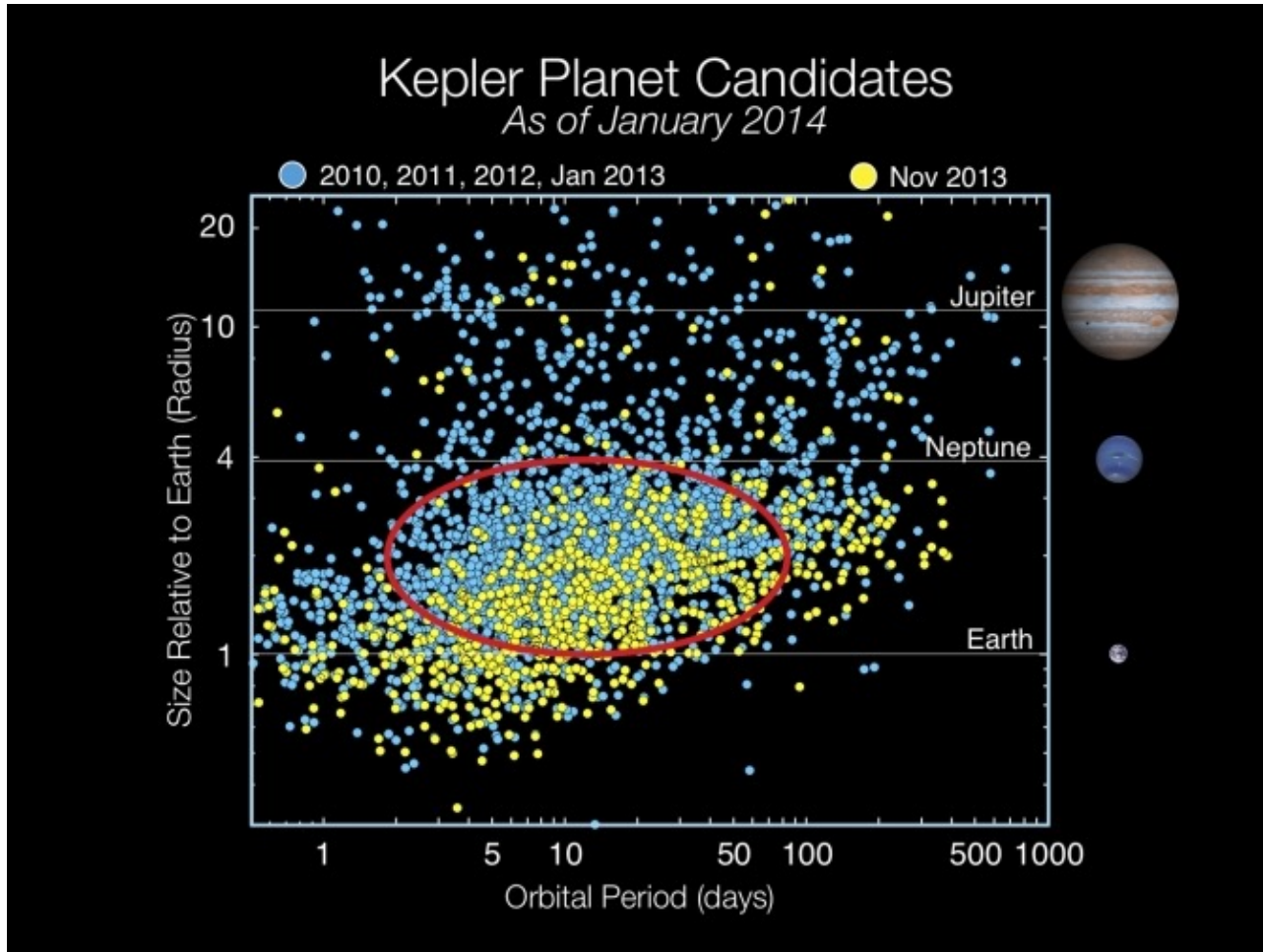
What technology and methods are used to detect exoplanets?



Try it!
Create your own transit now.

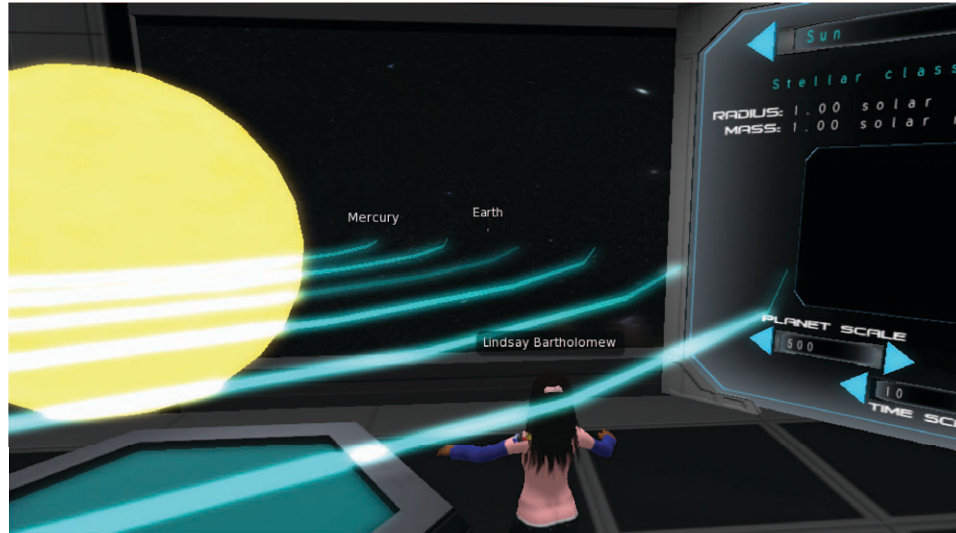
Essential Questions

What data has been gathered from NASA missions?



Essential Questions

How do exoplanetary systems compare with our own solar system?

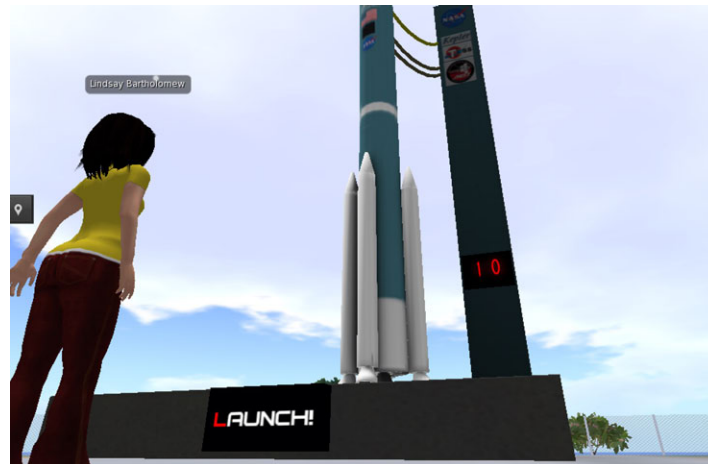


STEM Engagement

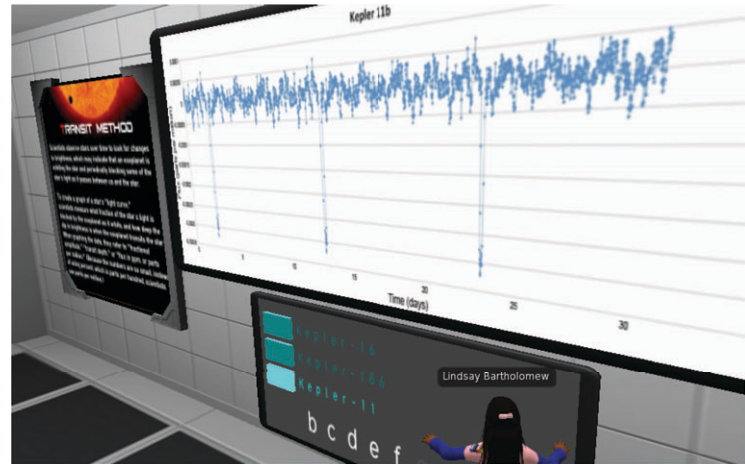
Science



Technology

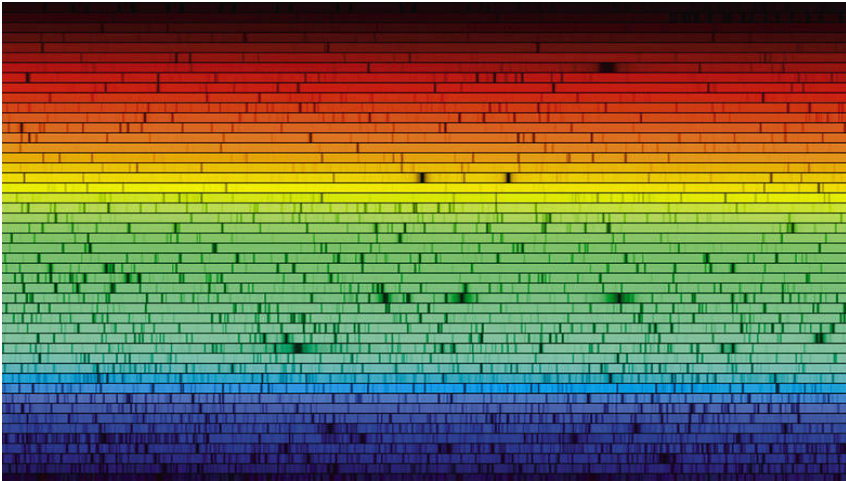
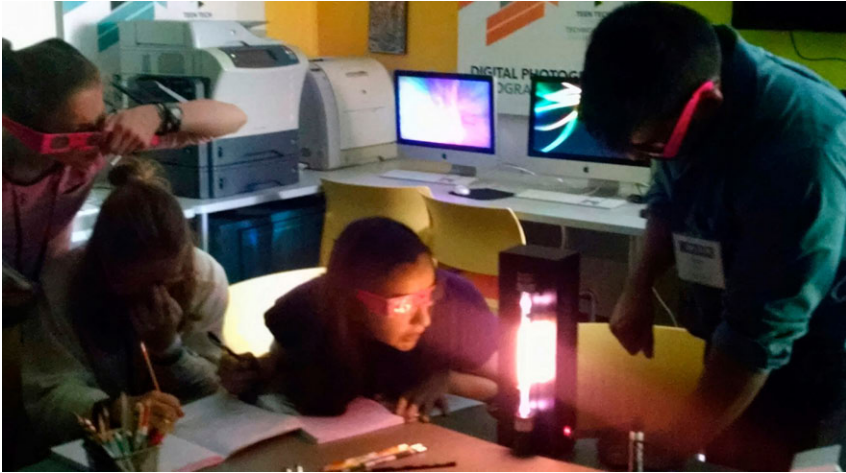


Engineering



Mathematics

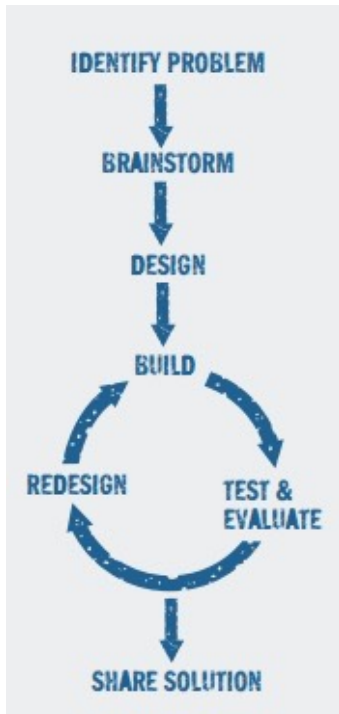
Authentic Tools



This spectrum of the Sun gives clues as to its composition.

Engineering Design Process

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SUPPLEMENTAL ACTIVITIES and WEBSITES						
NASA eClips Design Process Packet			NASA BEST Engineering Design Process			



STEM Career Connections

(NASA Astroventure)

Name: Tori Hoehler

Title: Research Scientist in Biochemistry and Astrobiology

What I do: I study life on Earth in order to better understand how to search for life on other worlds.

Education: B.S. in Chemistry
Ph.D. in Oceanography

Experience: five years in exobiology and astrobiology program at NASA

Skills: creativity, problem solving

Interests: cooking (especially spicy food), traveling, outdoor sports

"Make all the opportunities you can to do, see and experience as much as you can in your life."



Name: Kim Hubbard

Title: Computer Engineer

What I do: I develop software that supports science groups by helping them organize their research. I decide what I need to do for the program, write the code to carry it out, and test the software. I also upgrade the software if there are any problems.

Education: B.S. in Electrical Engineering

Experience: 7 years as an Airforce Officer, 9 years as a computer engineer.

Skills: computer programming, science (physics), computer electronics, mechanical systems.

Interests: designing jewelry and cooking

"Go out and do it! If you put your mind to it, you can do just about anything!"

Poll: Who is most applicable to exoplanet investigation?

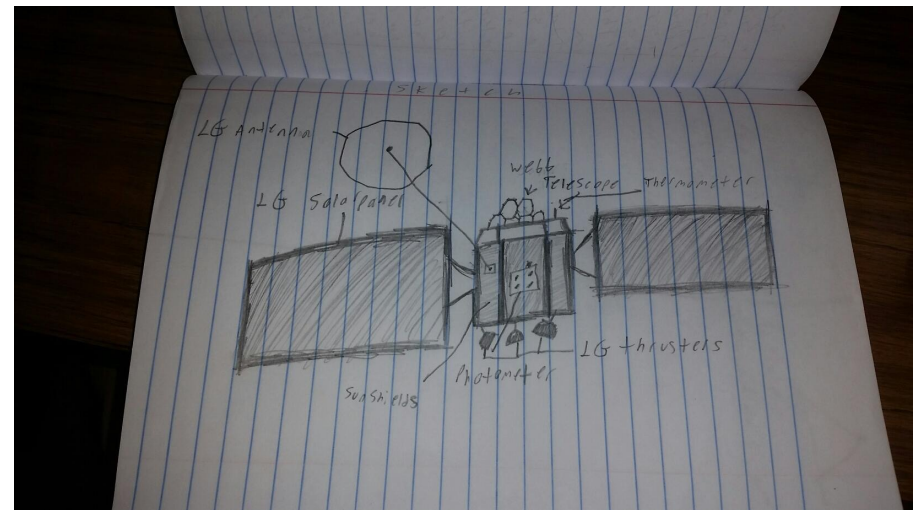
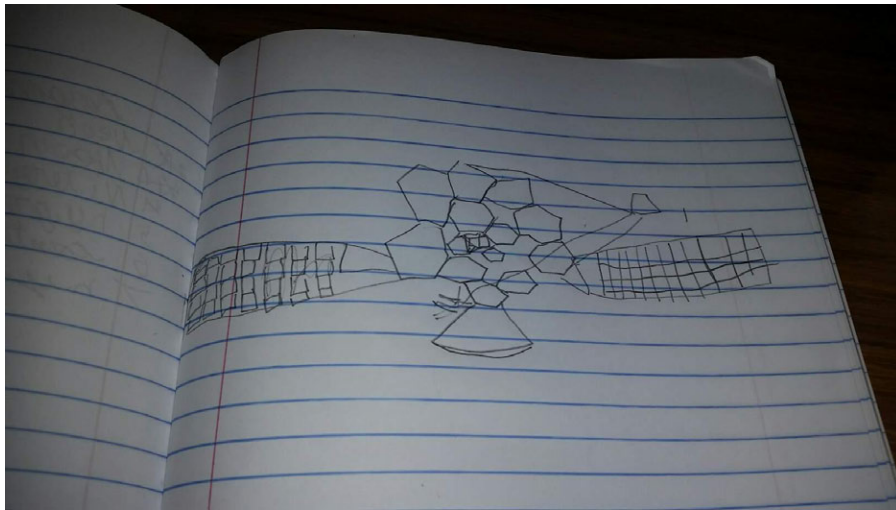
Astronomer
Biologist
Engineer
Geologist

Physicist
Chemist
Mathematician
Software Engineer

Mission Notebooks

Prompts throughout the curriculum encourage students to:

- Make sketches
- Take notes
- Synthesize thoughts
- Record data
- Organize teamwork



The 7E (not 5E) Model of Learning



Engage

Elicit

Explore

Explain

Elaborate

Extend

Evaluate

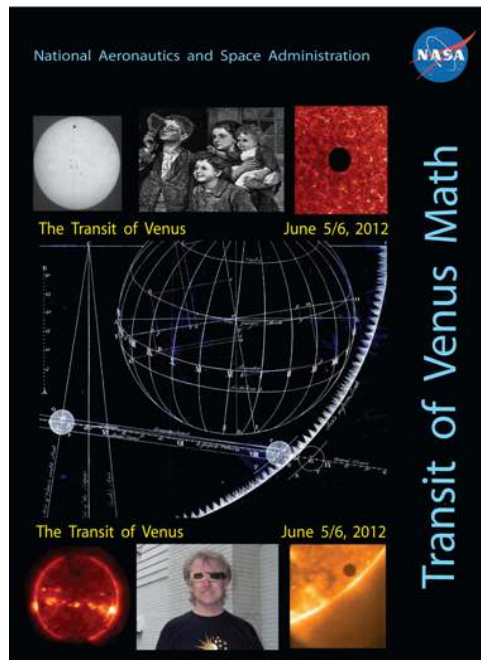
Next Generation Science Standards

- Develop and use models
- Analyze and interpret data
- Construct explanations
- Communicate ideas
- Use mathematical representations



Supplemental Resources

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SUPPLEMENTAL SPACE MATH@NASA PROBLEMS		SUPPLEMENTAL VIDEOS, SIMULATIONS, and MODELS				
SUPPLEMENTAL ACTIVITIES and WEBSITES						
Video -- Launchpad: The Search for Exoplanets			Video -- Launchpad: Transits (Venus Transit)			
Video -- Launchpad: Methane - An Indicator for Life?		Videos -- NASA and YOU		Videos -- NASA y Tú -- Exoplanetas		
Video -- SDO's View of the 2012 Venus Transit		Simulation -- Exoplanet Transit		Simulation -- Rocket Science 101		
Simulation -- JWST Build It Yourself: Satellite! Game		Model -- Kepler 3D	Flash Applet -- Light Grapher		Media -- 2012 Transit of Venus	



Running vMAX

Technology Requirements:

- Firestorm Software (free download)
- Ethernet connection (ideally)
- Your IT person for installation (if that's not you)
- vMAX Webinar Part 2: Technical Overview

Materials List:

- Some things from your school or museum supply closet
- A few things from your kitchen or desk drawer
- A couple new things to buy
- The Materials List in the Educator Implementation Guide

Assessments:

- Pre and Post Assessments

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AND EXOPLANETS

Universal Elements on All Days

DAILY AGENDA

TASK 1: FIND SOMEONE BINGO

**TASK 2: ENGAGE -- SCENARIO

TASK 3: ELICIT -- CHALLENGE BOARD

**TASK 4: EXPLORE -- INDIVIDUAL ACTIVITY

TASK 5: EXPLAIN -- GROUP DISCUSSION

**TASK 6: GETTING TO KNOW YOUR LOCATION

TASK 7: EXPLORE -- VIDEO

**TASK 8: EXPLORE -- SMALL GROUP ACTIVITIES

TASK 9: EXPLORE -- VIDEO

**TASK 10: EXPLORE -- ACTIVITY

**TASK 11: EXPLORE -- PAIRED RESEARCH

**TASK 12: EXPLORE: VIRTUAL WORLD TOUR AND STUDENT EXPERIENCES

TASK 13: EXPLAIN AND EVALUATE -- DEBRIEF

<http://www.livebinders.com/media/get/MTMyMjU2OTc=>

vMAX

VIRTUAL MISSIONS
AND EXOPLANETS



Engage (Scenario)



Elicit

(Challenge Board)

	<i>What do you KNOW?</i>	<i>HOW do you know this?</i>	<i>WHAT do you NEED to know to complete this challenge?</i>	What did you LEARN from your exploration?
Day One				
Day Two				
Day Three				
Day Four			<p>Guide your students to ask these questions:</p> <p><i>How do your exoplanets compare to Earth?</i></p> <p><i>Are any of your exoplanets "habitable?"</i></p> <p><i>Which exoplanet should be further explored and why?</i></p> <p><i>What limiting factors may affect this choice?</i></p>	
Day Five				

Explore

(Research and Hands-On Activities)



Explain

(Collaboration, Face-to-Face, Via Virtual World)



Elaborate

(Debate, Decisions, Design)

WHAT WILL YOU ADD TO YOUR VEHICLE?

<input type="checkbox"/>	SOLAR PANELS SM
<input type="checkbox"/>	SOLAR PANELS LG
<input type="checkbox"/>	TELESCOPE (KEPLER)
<input type="checkbox"/>	TELESCOPE (WEBB)
<input type="checkbox"/>	ANTENNA SM
<input type="checkbox"/>	ANTENNA LG
<input type="checkbox"/>	STAR TRACKER
<input type="checkbox"/>	REACTION WHEELS
<input type="checkbox"/>	PHOTOMETER
<input type="checkbox"/>	THRUSTERS SM
<input type="checkbox"/>	THRUSTERS LG
<input type="checkbox"/>	SUNSHIELDS
<input type="checkbox"/>	THERMOMETER
<input type="checkbox"/>	SPECTROMETER
<input type="checkbox"/>	STAR SHADE

30

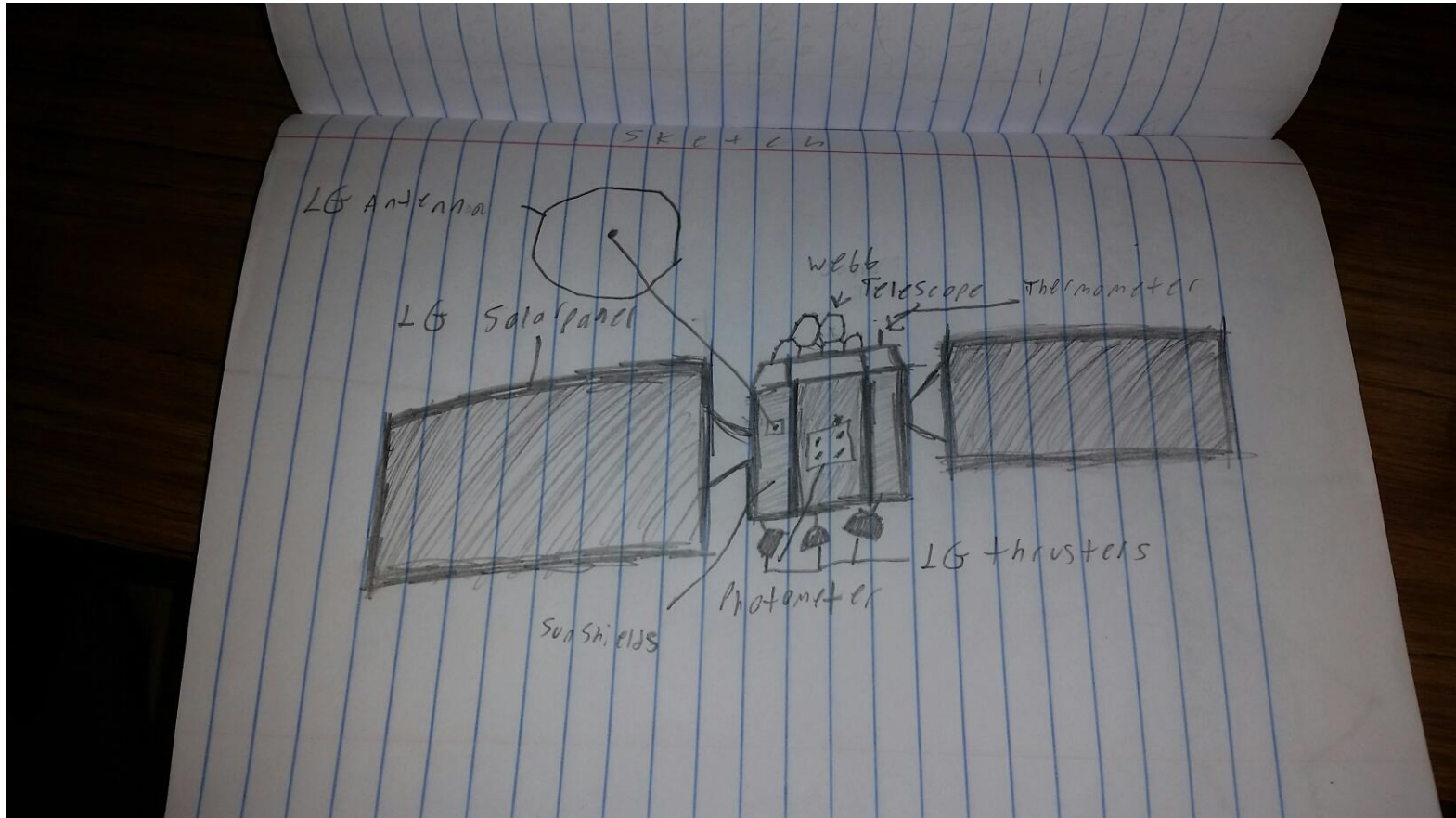
POINTS REMAINING



Poll:
What are your priority elements to include in your design?

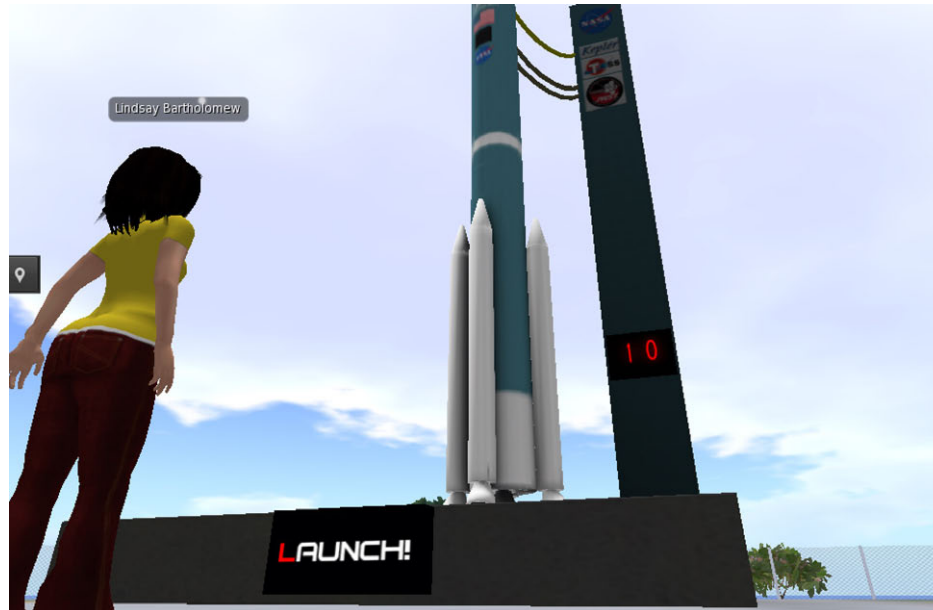
Evaluate

(Mission Notebooks, Designs)



Extend

(Virtual and physical rocket experiences)



The Student LiveBinder



vMax Educator Implementation Guide

By: [swbowers](#)

vMAX Overview

Assessments

Day One

Day Two

Day Three

Day Four

Day Five

DAILY AGENDA

****TASK 1: ENGAGE AND ELICIT -- SCENARIO AND CHALLENGE BOARD**

****TASK 2: EXPLORE -- CAREER AND ROLE MODEL SELECTION**

TASK 3: ROLE MODEL BINGO

****TASK 4: EXPLORE -- EXOPLANET TEAM RESEARCH**

****TASK 5: EXPLORE -- DIMITAR SASSELOV**

TASK 6: EXPLAIN -- WHOLE GROUP DEBRIEF

****TASK 7: EXPLORE AND EXPLAIN -- GROUP ACTIVITIES**

****TASK 8: EXPLORE AND EXPLAIN -- VIRTUAL WORLD EXPERIENCES**

****TASK 9: EXPLORE -- VIRTUAL WORLD TEAM LAB ROOMS**

TASK 10: EXPLAIN AND EVALUATE -- DEBRIEF

Student LiveBinder

Activity One: Transit Method

Activity Two: Direct Imaging Method

Activity Three: Wobble Method

<http://www.livebinders.com/play/play?id=1956402>



Sign Up Log In



Search tab names



vMax Student LiveBinder

By: [swbowers](#)

vMAX Overview

Day One

Day Two

Day Three

Day Four

Day Five

TASK 1: SCENARIO

TASK 2: CAREER AND ROLE MODEL SELECTION

TASK 4: EXOPLANET TEAM RESEARCH

TASK 5: DIMITAR SASSELOV

TASK 7: GROUP ACTIVITIES

TASK 8: VIRTUAL WORLD EXPERIENCES

TASK 9: VIRTUAL WORLD TEAM LAB ROOMS

Activity One: Transit Method

Activity Two: Direct Imaging Method

Activity Three: Wobble Method



VIRTUAL MISSIONS
AND EXOPLANETS

Exoplanet Scavenger Hunt

You Explore: vMAX Educator Implementation Guide

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SUPPLEMENTAL VIDEOS, SIMULATIONS, and MODELS	SUPPLEMENTAL ACTIVITIES and WEBSITES					

Group 1

Day One

Day Two

Group 2

Day Three

Day Four

Day Five

www.miamisci.org/vmax

Note: Will soon be located at www.frostscience.org



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Any Questions

?



VIRTUAL MISSIONS
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To Be Continued...

Part 2: Technical Overview Webinar

How to download, install, troubleshoot, create avatars



VIRTUAL MISSIONS
AND EXOPLANETS

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National Institute of Aerospace

Dr. Sharon Bowers: sharon.bowers@nianet.org

Resources

vMAX Curriculum

www.miamisci.org/vmax (soon located at www.frostsscience.org)

vMAX Virtual World Fly-Through Video

<https://www.youtube.com/watch?v=e5Wgr4aADLU>

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