



vMAX: Virtual Missions and Exoplanets  
Webinar Series, Part 1



# Webinar Series

## Part 1: Curriculum Overview

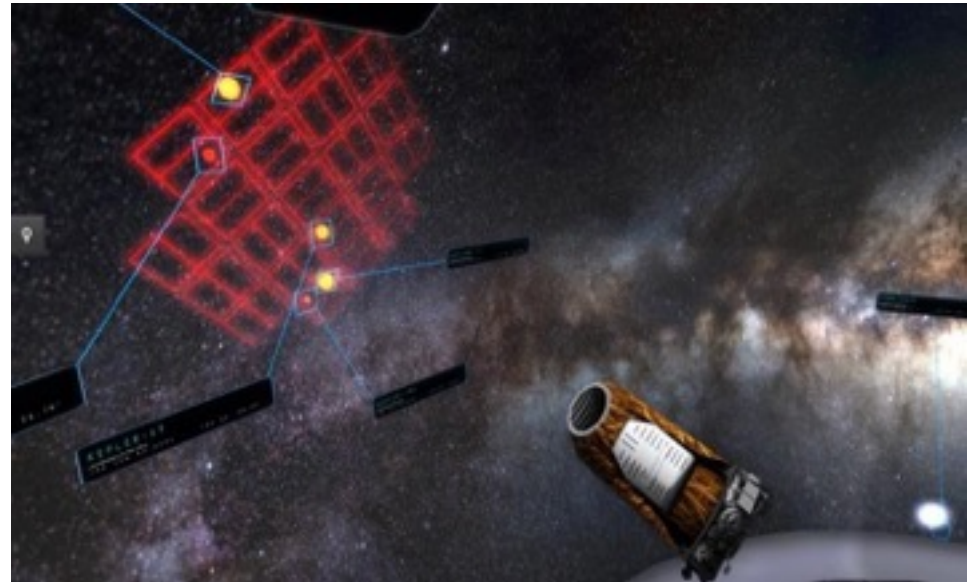


Based upon work supported by NASA under grant award No. NNX14AD07G. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration.



# 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



# 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

<b>vMAX Overview</b>	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

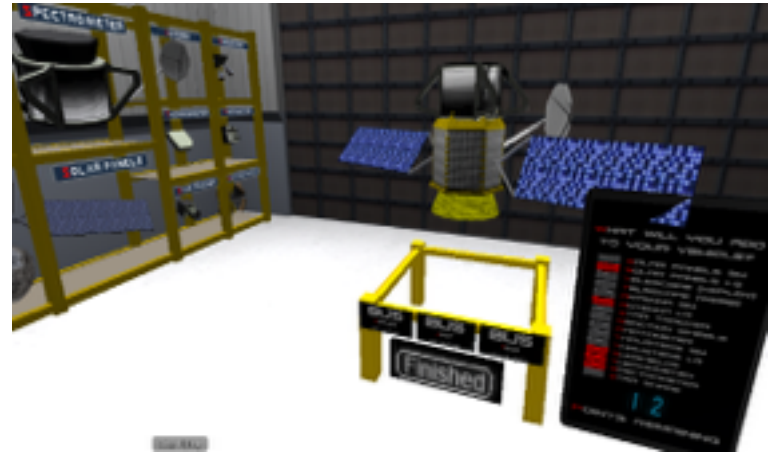
Inquiry



Collaboration

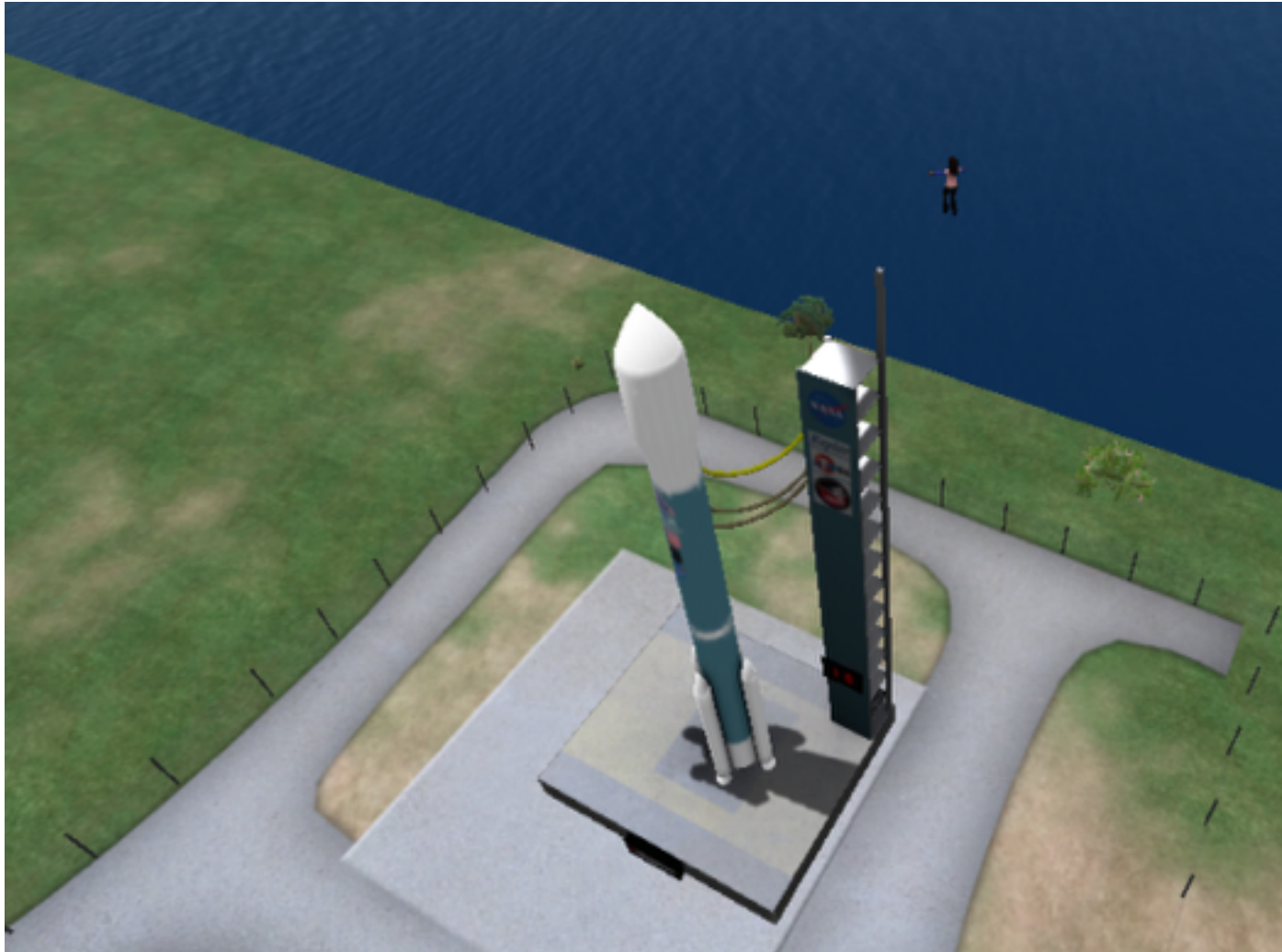


Critical thinking



Creativity

# New Technologies



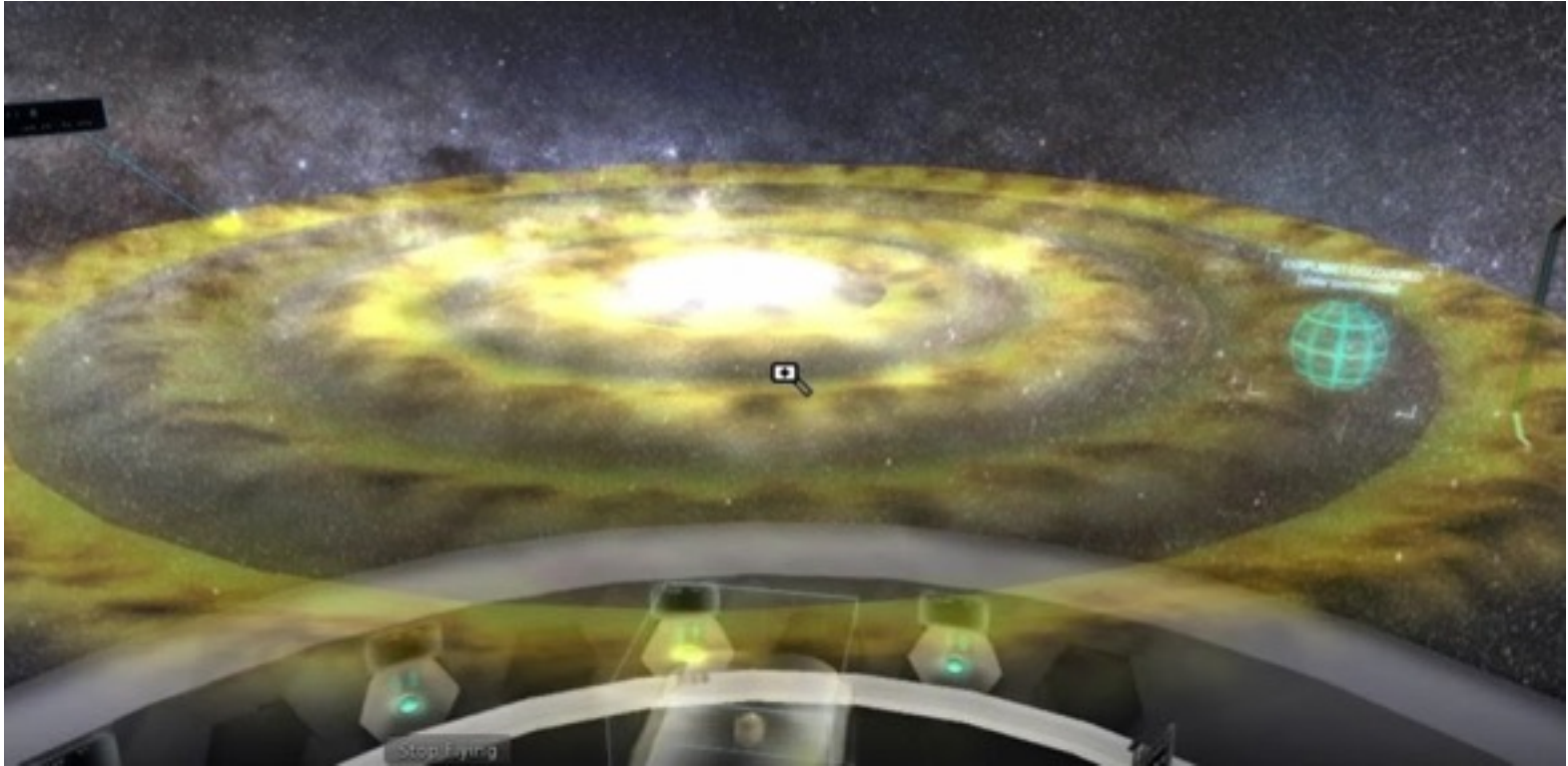


VIRTUAL MISSIONS  
AND EXOPLANETS

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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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?

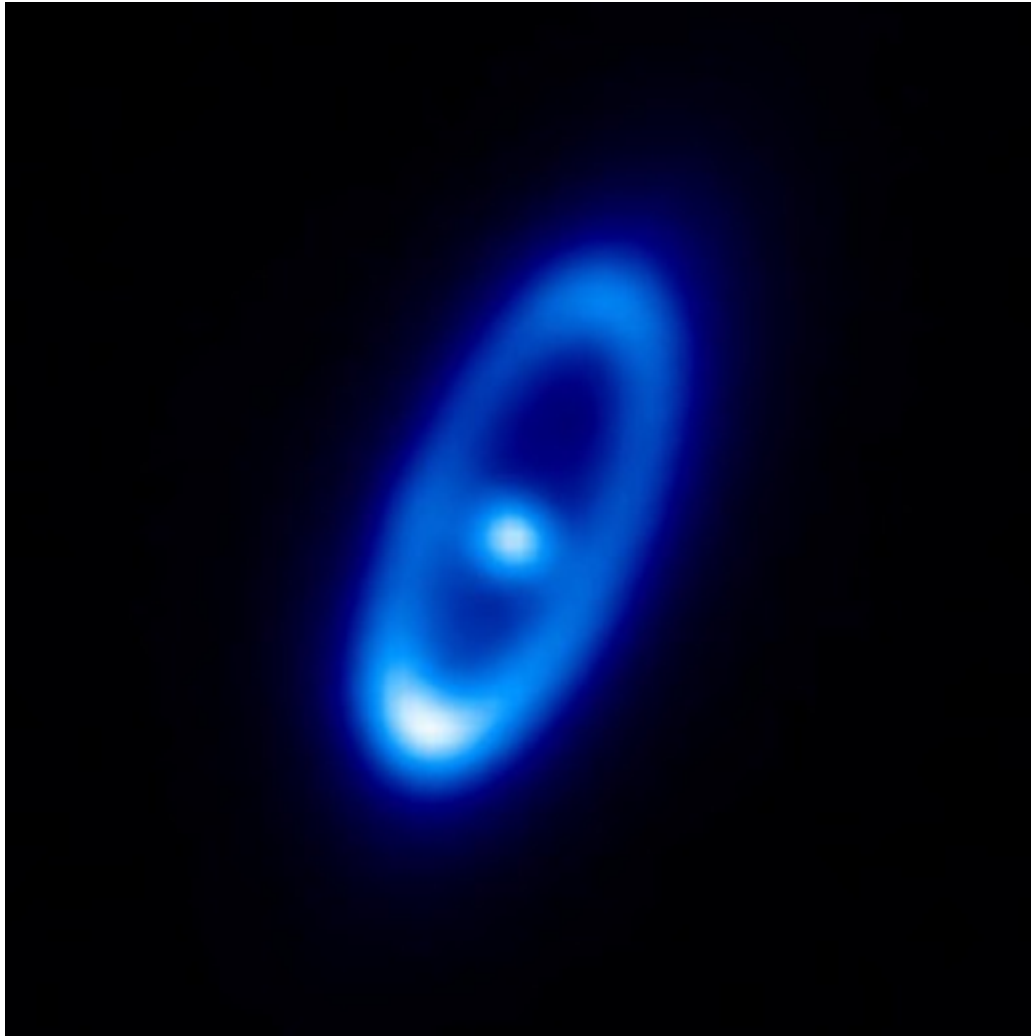
Day 5: What technology is needed to accomplish that? Does it exist? Is it possible?

# Collaborations (Museums/Schools/etc)



# Essential Questions

What are exoplanets?



# Essential Questions

Why should we care about exoplanets?

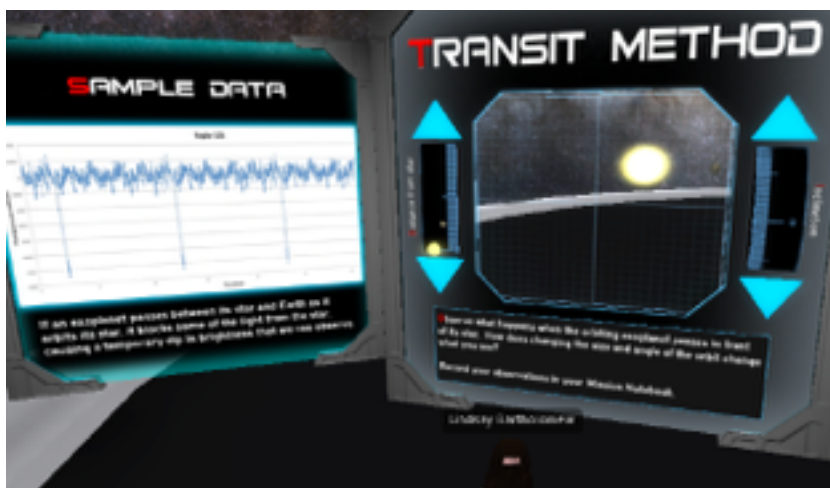


Poll:

Should we continue to search for exoplanets?

# Essential Questions

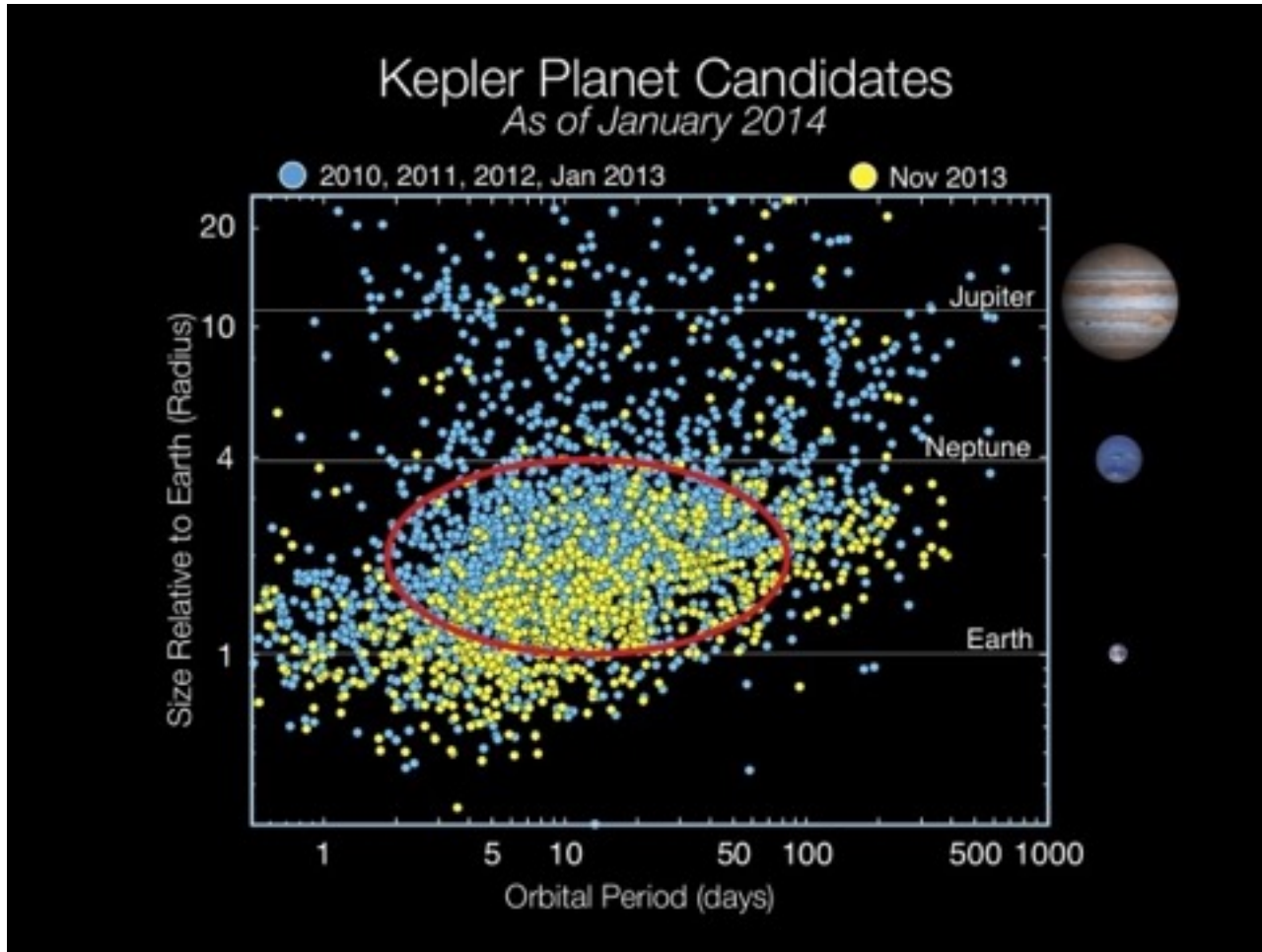
What technology and methods are used to detect exoplanets?



Try it!  
Create your own transit now.

# Essential Questions

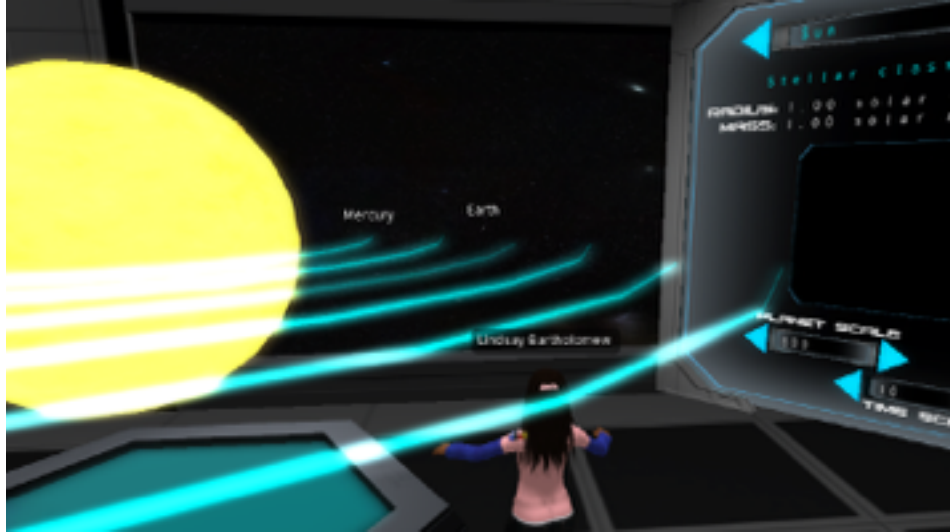
What data has been gathered from NASA missions?





# Essential Questions

How do exoplanetary systems compare with our own solar system?



# STEM Engagement

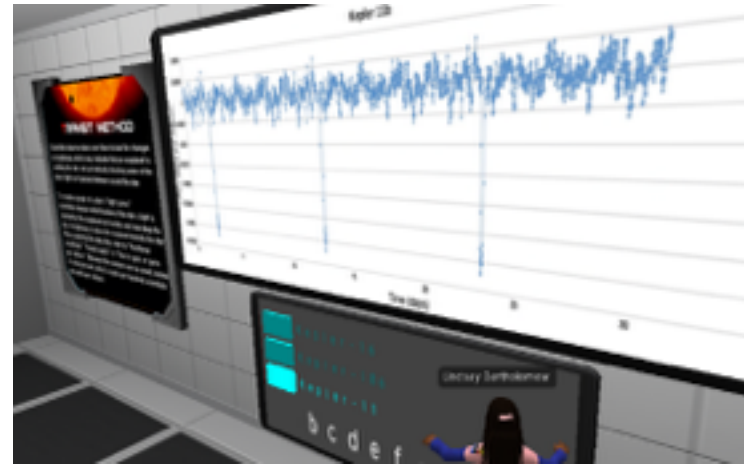
Science



Technology

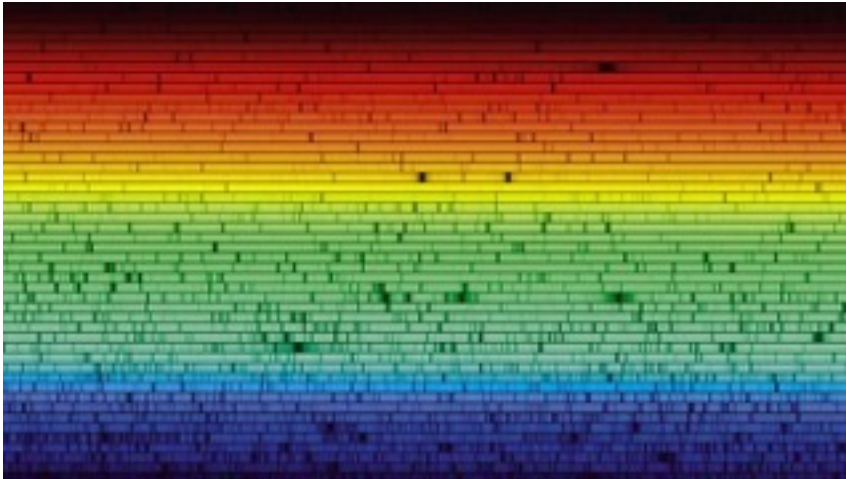


Engineering



Mathematics

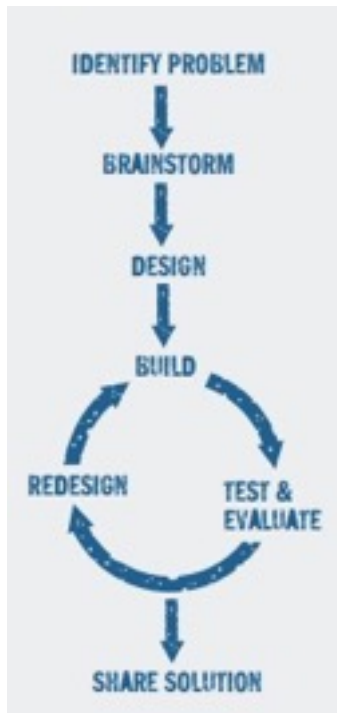
# Authentic Tools



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

# Engineering Design Process

<b>vMAX Overview</b>	<b>Assessments</b>	<b>Day One</b>	<b>Day Two</b>	<b>Day Three</b>	<b>Day Four</b>	<b>Day Five</b>
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<b>NEXT GENERATION SCIENCE STANDARDS</b>		<b>TECHNOLOGY REQUIREMENTS</b>	<b>MATERIALS LIST</b>			
<b>SUPPLEMENTAL SPACE MATH@NASA PROBLEMS</b>		<b>SUPPLEMENTAL VIDEOS, SIMULATIONS, and MODELS</b>				
<b>SUPPLEMENTAL ACTIVITIES and WEBSITES</b>						
<b>NASA eClips Design Process Packet</b>			<b>NASA BEST Engineering Design Process</b>			



# 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.

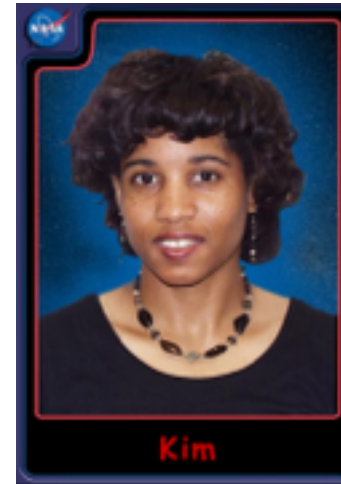
**Education:** B.S. in Chemistry  
Ph.D. in Oceanography

**Experiences:** 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?

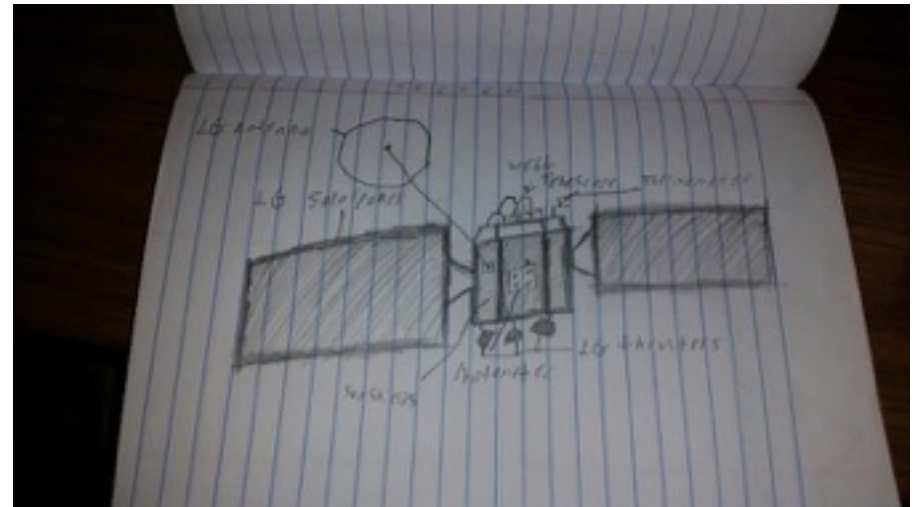
Astronomer  
Biologist  
Engineer  
Geologist

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

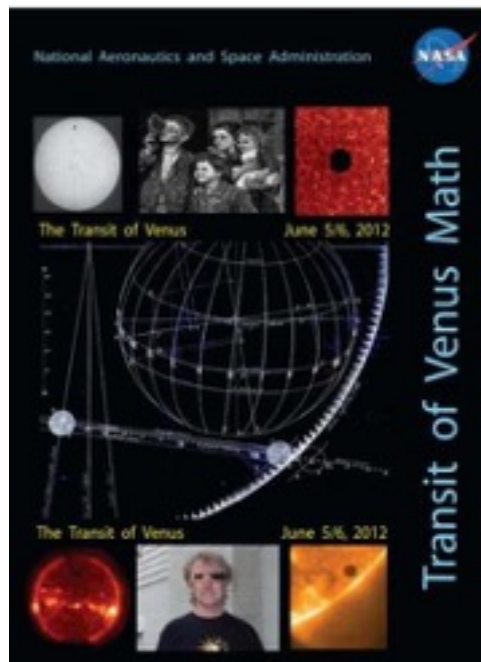
- Develop and use models
- Analyze and interpret data
- Construct explanations
- Communicate ideas
- Use mathematical





# Supplemental Resources

<b>vMAX Overview</b>	<b>Assessments</b>	<b>Day One</b>	<b>Day Two</b>	<b>Day Three</b>	<b>Day Four</b>	<b>Day Five</b>
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<b>NEXT GENERATION SCIENCE STANDARDS</b>		<b>TECHNOLOGY REQUIREMENTS</b>		<b>MATERIALS LIST</b>		
<b>SUPPLEMENTAL SPACE MATH@NASA PROBLEMS</b>		<b>SUPPLEMENTAL VIDEOS, SIMULATIONS, and MODELS</b>				
<b>SUPPLEMENTAL ACTIVITIES and WEBSITES</b>						
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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VIRTUAL MISSIONS  
AND EXOPLANETS

Universal Elements on All Days

vMAX Overview

Assessments

Day One

Day Two

Day Three

Day Four

Day Five

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 <i>LEARN</i> 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

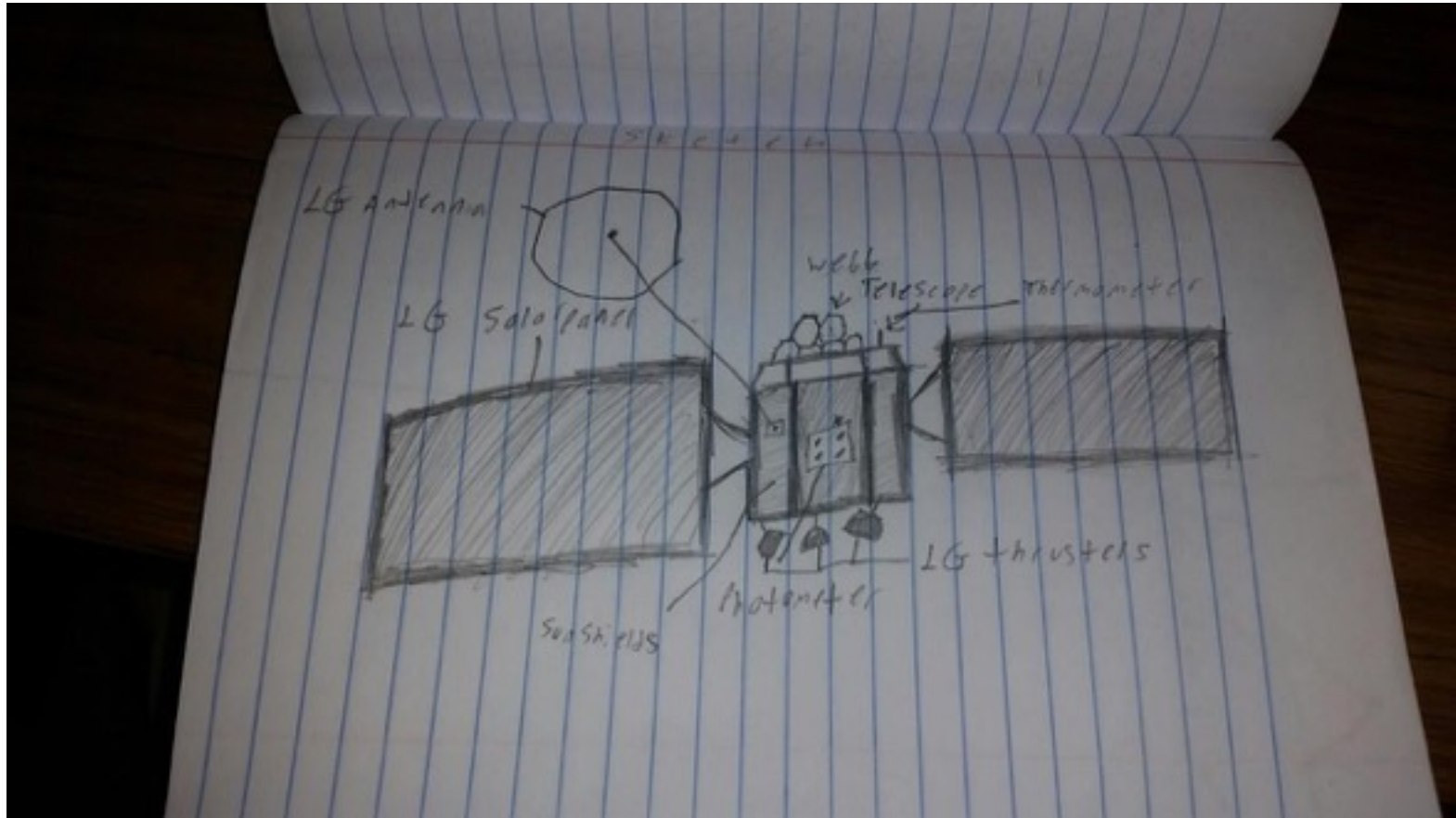
(Debate, Decisions, Design)



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

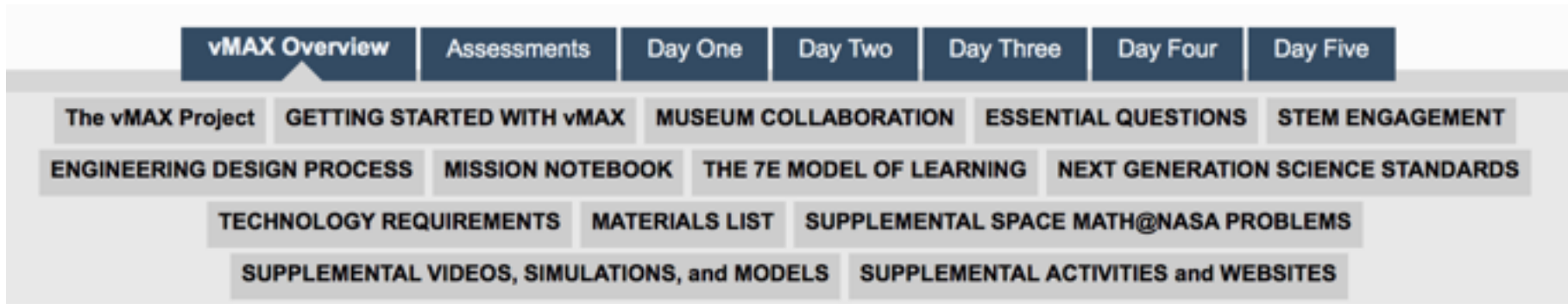
Activity Three: Wobble Method



VIRTUAL MISSIONS  
AND EXOPLANETS

## Exoplanet Scavenger Hunt

# You Explore: vMAX Educator Implementation Guide



Group 1

Day One

Day Two

Group 2

Day Three

Day Four

Day Five

[www.miamisci.org/vmax](http://www.miamisci.org/vmax)

Note: Will soon be located at [www.frostscience.org](http://www.frostscience.org)



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VIRTUAL MISSIONS  
AND EXOPLANETS

Any Questions

?



VIRTUAL MISSIONS  
AND EXOPLANETS

To Be Continued...

## Part 2: Technical Overview Webinar

How to download, install, troubleshoot, create avatars

September 22, 4:00 PM – 5:00 PM ET







## **Contacts**

Patricia and Phillip Frost Museum of Science  
Lindsay Bartholomew: lbartholomew@frostsscience.org

National Institute of Aerospace  
Dr. Sharon Bowers: sharon.bowers@nianet.org

## **Resources**

vMAX Curriculum

[www.miamisci.org/vmax](http://www.miamisci.org/vmax) (soon located at [www.frostsscience.org](http://www.frostsscience.org))

vMAX Virtual World Fly-Through Video  
<https://www.youtube.com/watch?v=e5Wgr4aADLU>