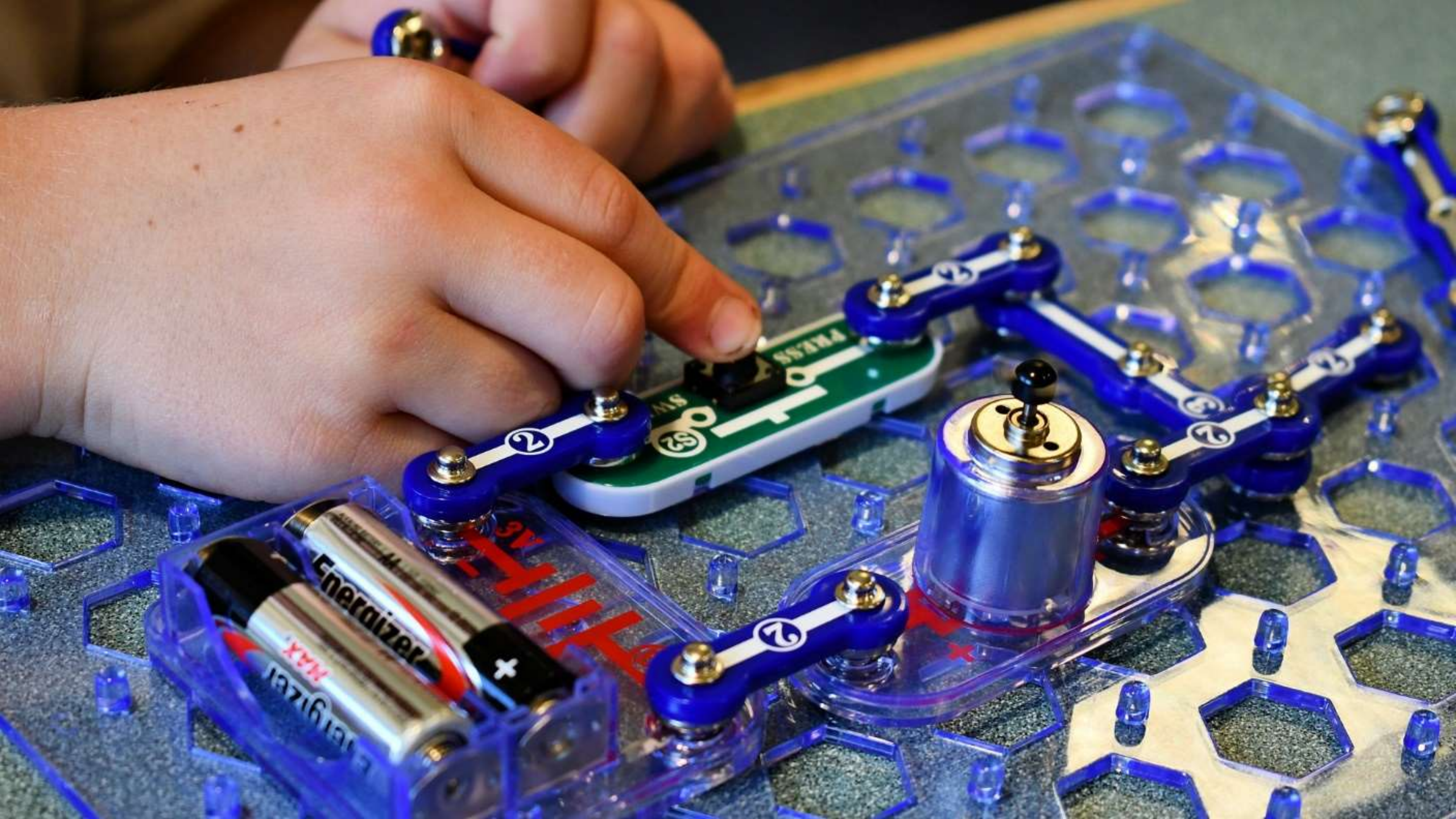
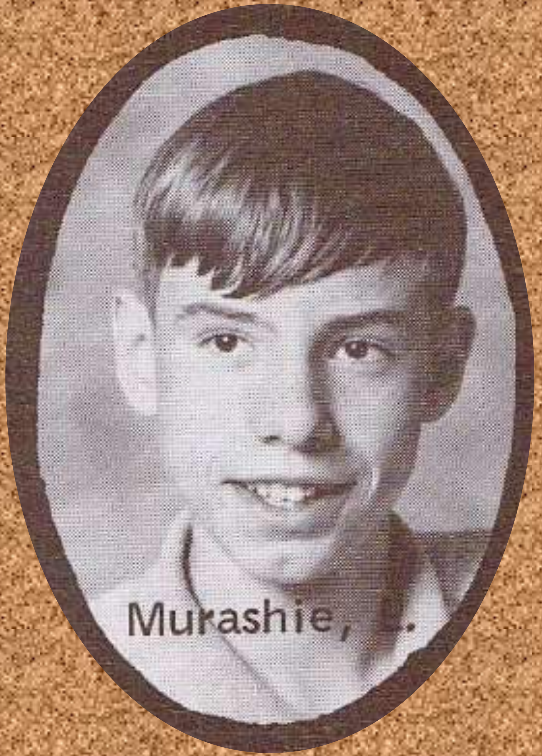
Ed Murashie

ProEngineered Solutions

NGSS
Motivation
Satellite Imagery

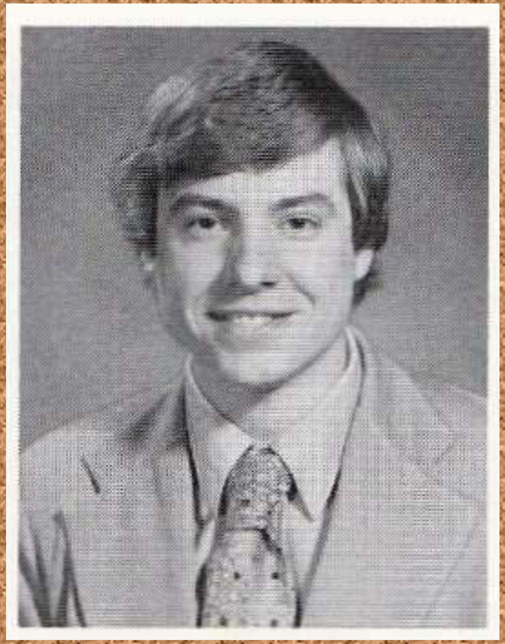
Success!

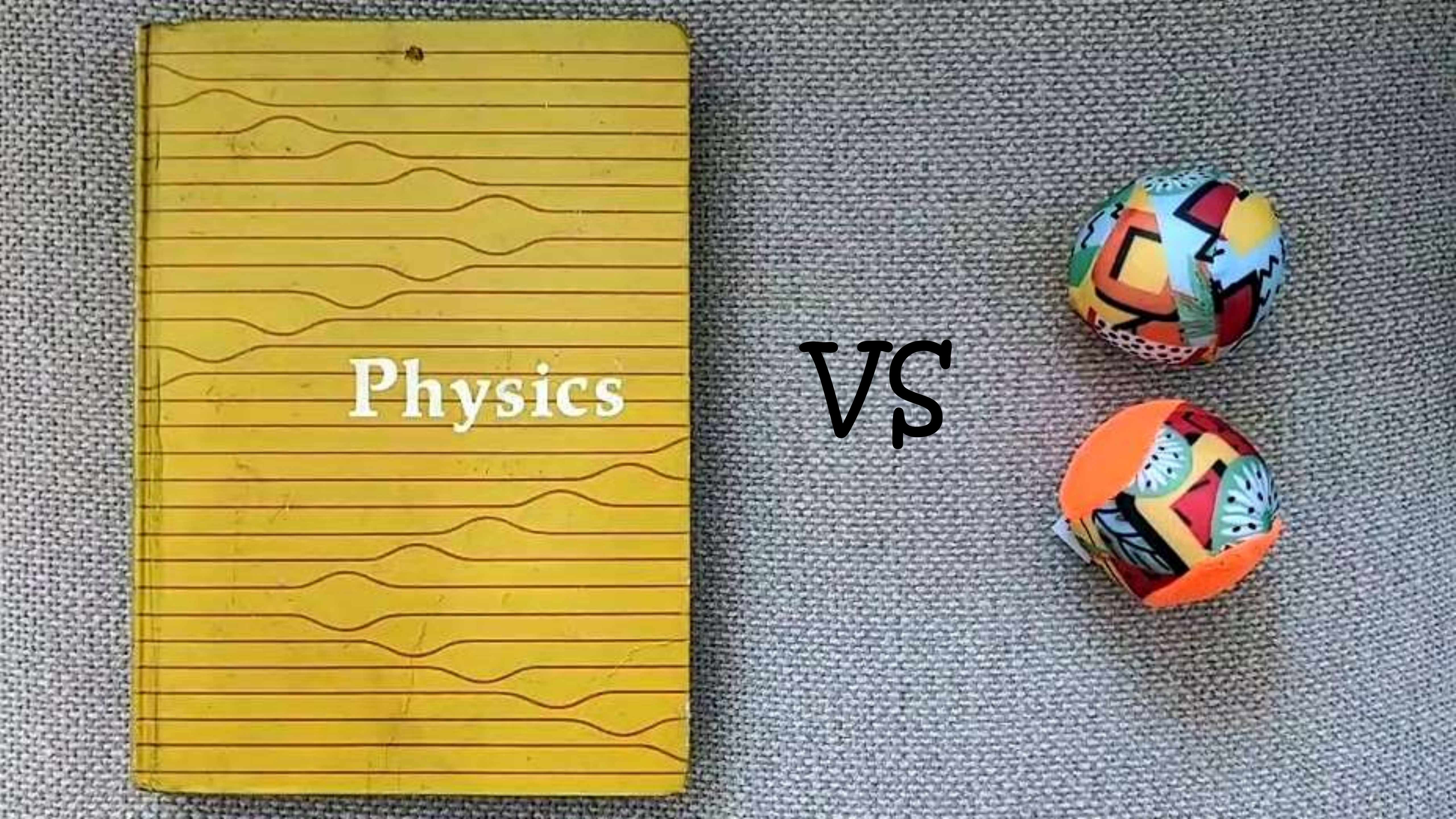

Energizer



Cal Poly
1985

Don
Bosco
1974




Physics
VS


DO ODIO

?

Next Generation Science Standards

5-PS2 Motion and Stability: Forces and Interactions

5-PS2 Motion and Stability: Forces and Interactions		
Students who demonstrate understanding can: **5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.** [Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]		
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). ▪ Support an argument with evidence, data, or a model. (5-PS2-1)	**PS2.B: Types of Interactions** ▪ The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (5-PS2-1)	**Cause and Effect** ▪ Cause and effect relationships are routinely identified and used to explain change. (5-PS2-1)
Connections to other DCIs in fifth grade: N/A		
Articulation of DCIs across grade-levels: **3.PS2.A** (5-PS2-1); **3.PS2.B** (5-PS2-1); **MS.PS2.B** (5-PS2-1); **MS.ESS1.B** (5-PS2-1); **MS.ESS2.C** (5-PS2-1)		
Common Core State Standards Connections: *ELA/Literacy –* **RI.5.1** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. *(5-PS2-1)* **RI.5.9** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-PS2-1) **W.5.1** Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-PS2-1)		

Disciplinary Core Ideas

PS2.B: Types of Interactions

- The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (5-PS2-1)

Science and Engineering Practices

New!

Engaging in Argument from Evidence

Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).

- Support an argument with evidence, data, or a model. (5-PS2-1)

Ask Questions

Models

Investigations

Analyze Interpret Data

Construct Explanations

Obtain Evaluate Communicate Info

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change. (5-PS2-1)

New!

Patterns

Scale
Proportion
Quantity

Systems
Models

Energy
Matter

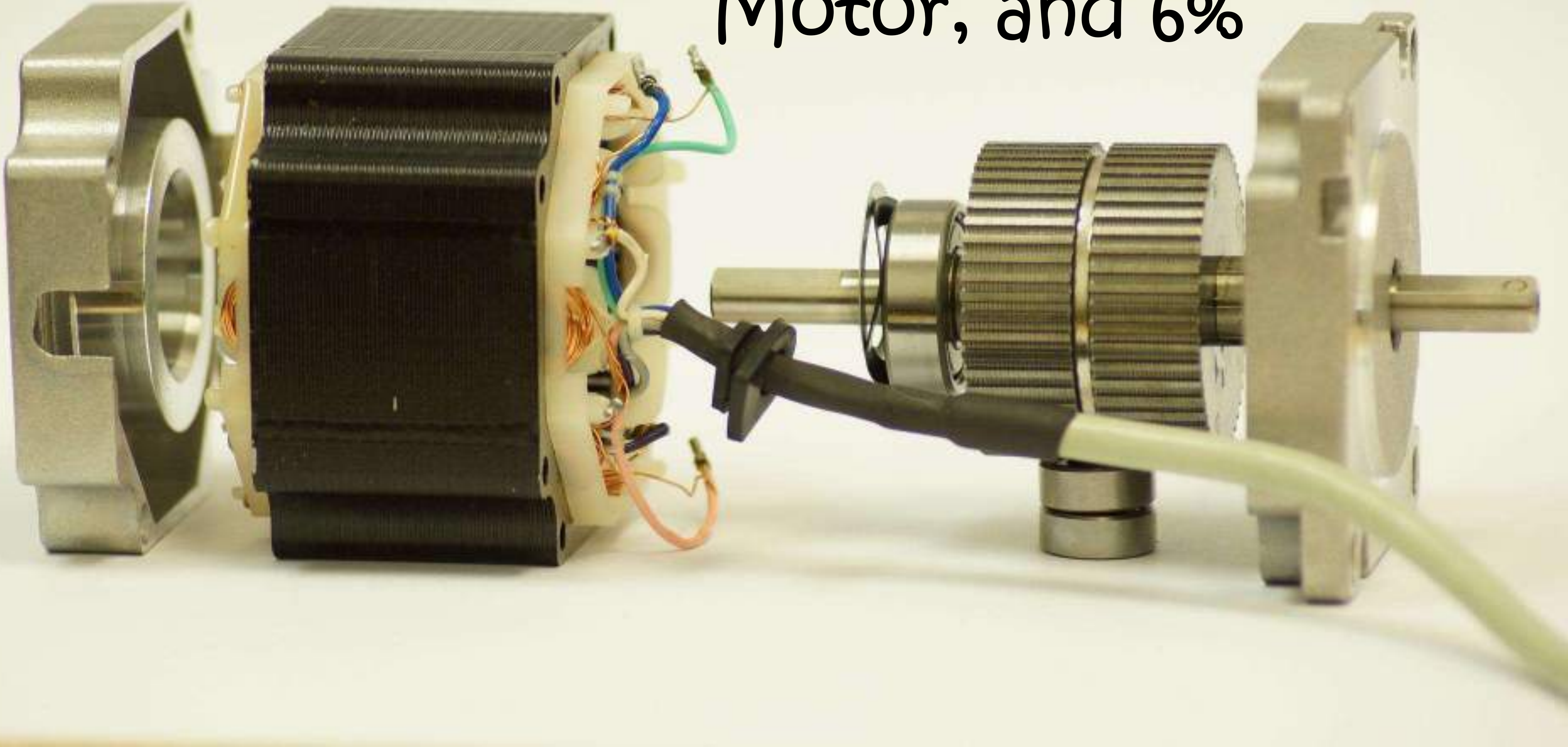
Structure
Function

Stability
Change


Mile wide
inch deep

Topic	Primary School (Grades K-2)	Elementary School (Grades 3-5)	Middle School (Grades 6-8)	High School (Grades 9-12)
PS2: Motion and Stability: Forces and Interactions				
PS2.B: Types of Interactions	• When objects touch or collide, they push on one another and can change motion. (K-PS2-1)	• Objects in contact exert forces on each other. (3-PS2-1) • Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3),(3-PS2-4) • The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (5-PS2-1)	• Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3) • Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. (MS-PS2-4) • Forces that act at a distance (electric and magnetic) can be explained by fields that extend through space and can be mapped by their effect on a test object (a ball, a charged object, or a magnet, respectively). (MS-PS2-5)	• Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (HS-PS2-4) • Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS-PS2-4),(HS-PS2-5) • Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS-PS2-6),(secondary to HS-PS1-1),(secondary to HS-PS1-3)

Gordon, Dale, the Motor, and 6%



Motivation Tips

Engaging Activities

Classroom Projects

Real Life – Current Events

Active Participation

Assignment Choice

NGSS
Lesson
Plans

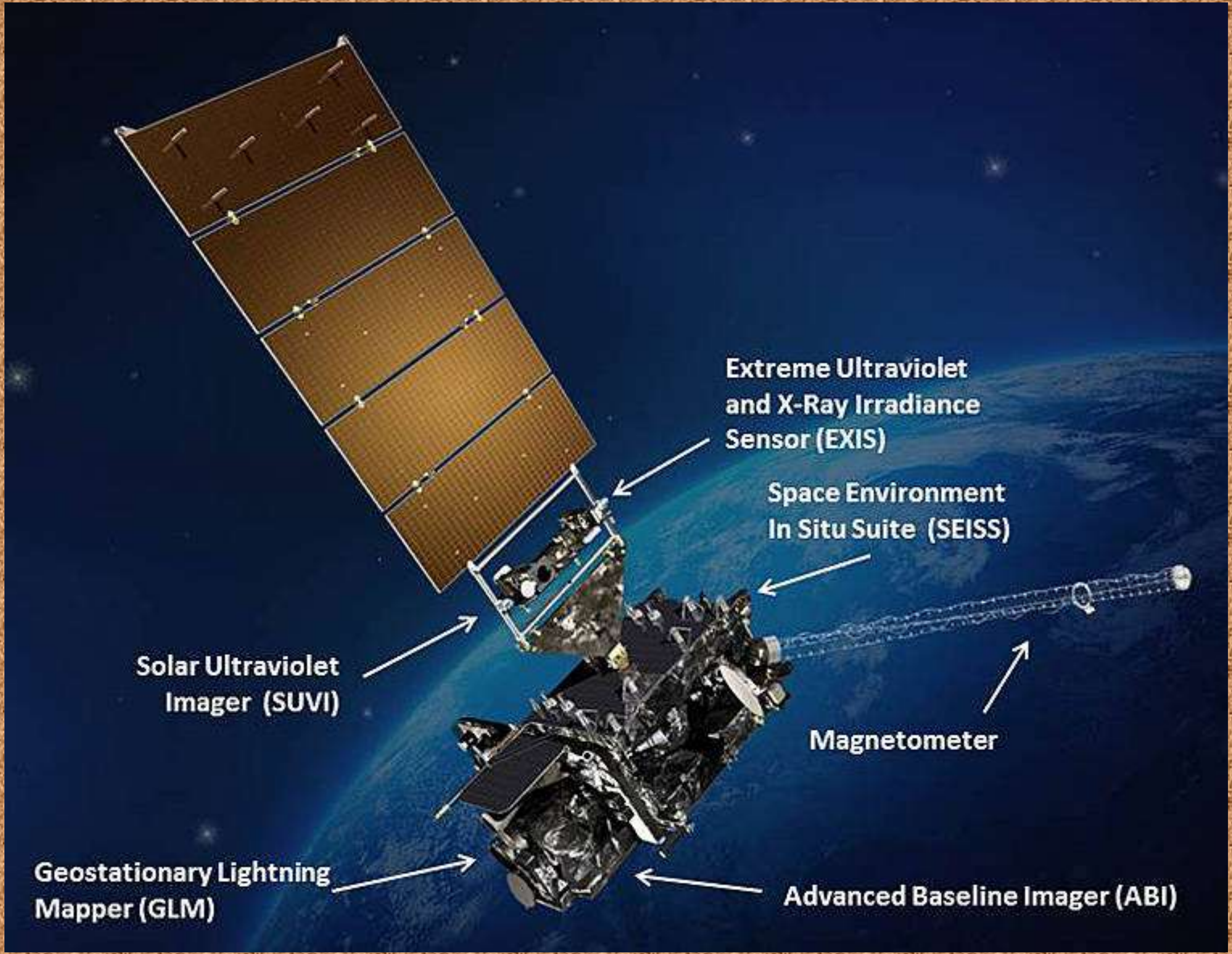
Equipment
& Data

Mon	Tues	Wed	Thurs	Fri
Waves Energy GOES	Earth Systems GOES	Space Science JWT	Life Science Landsat	Physics NOAA

Dear SEA,

Congrats, you have been selected to design and launch the Next Gen weather satellite. But you must use NGSS.

Regards,
NOAA/NASA




Credit: NASA

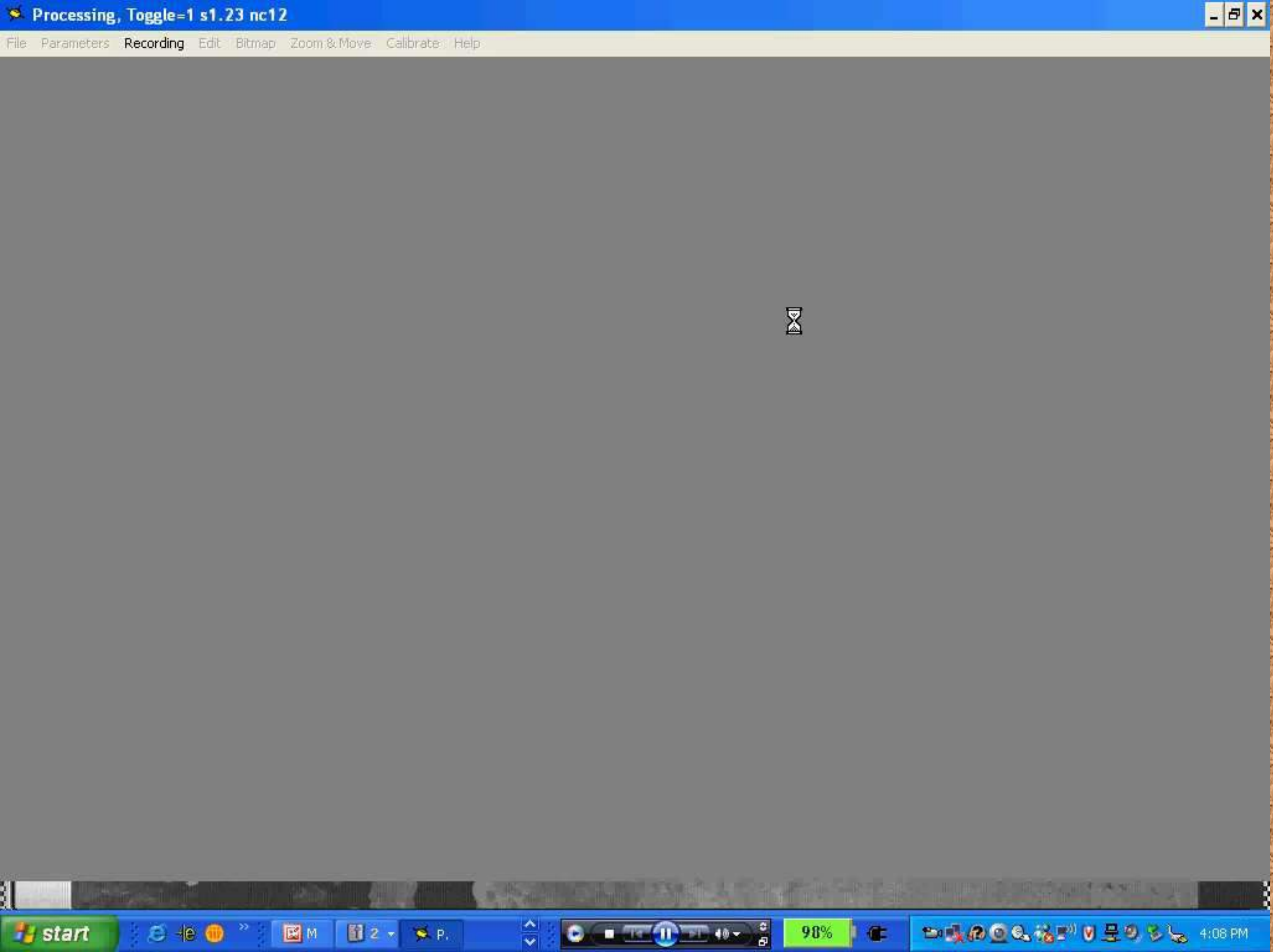
ULA Atlas V GOES-S

What do we tell them?


NATIONAL HURRICANE CENTER
NATIONAL WEATHER SERVICE
INTERNATIONAL UNIVERSITY
NOAA
NATIONAL WEATHER SERVICE
HLITE
STYLE
INPUT
PRINT
SAVE
MENU

Orbits

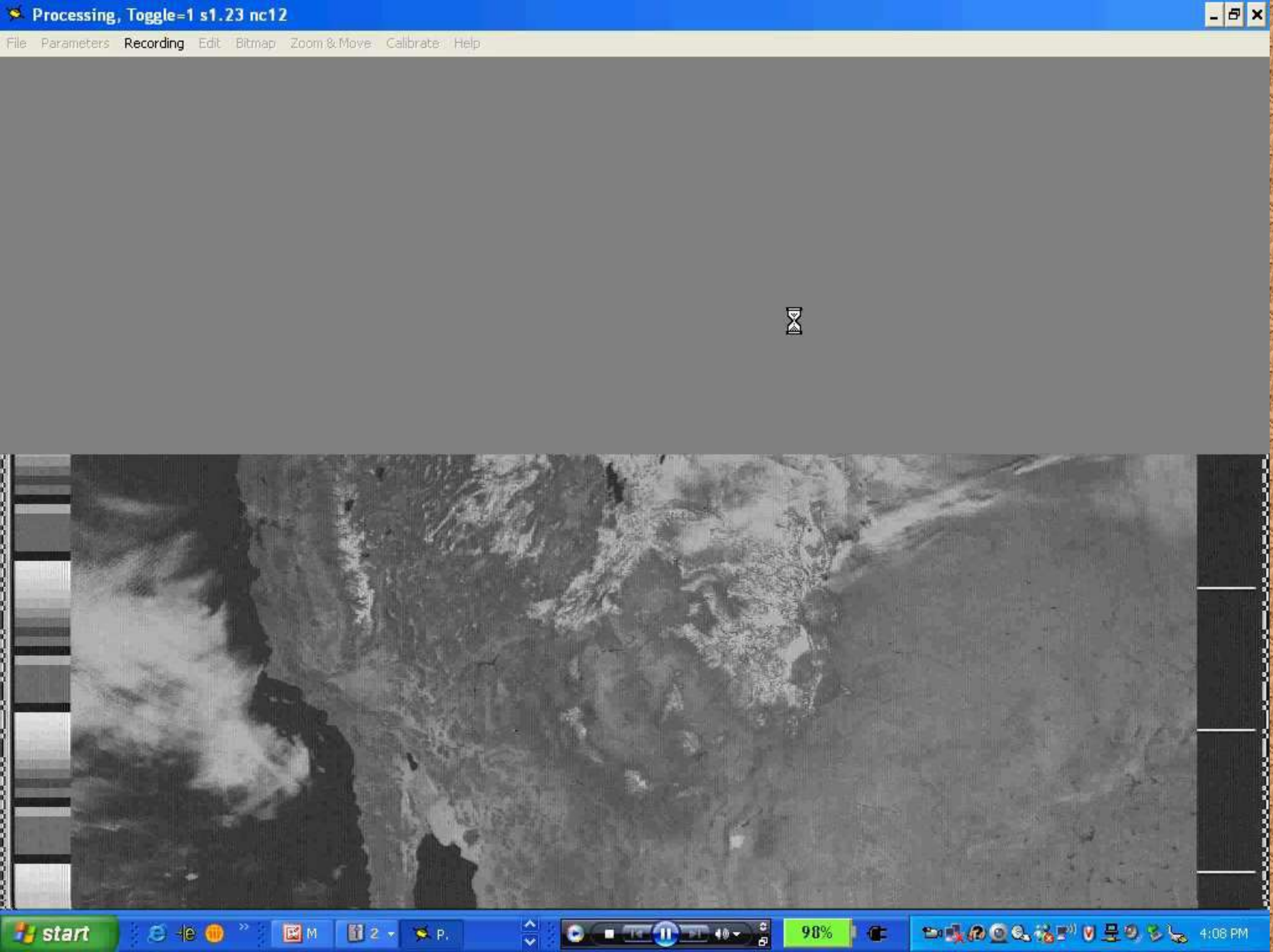

140.7° E
128.2° E
105° E
90° E
86.5° E
82° E
78° E
74° E
41.5° E
9.5° E
3.4° W
180° W
137° W
135° W
105° W
89.5° W
75° W



Low Orbit?

Geo Orbit?

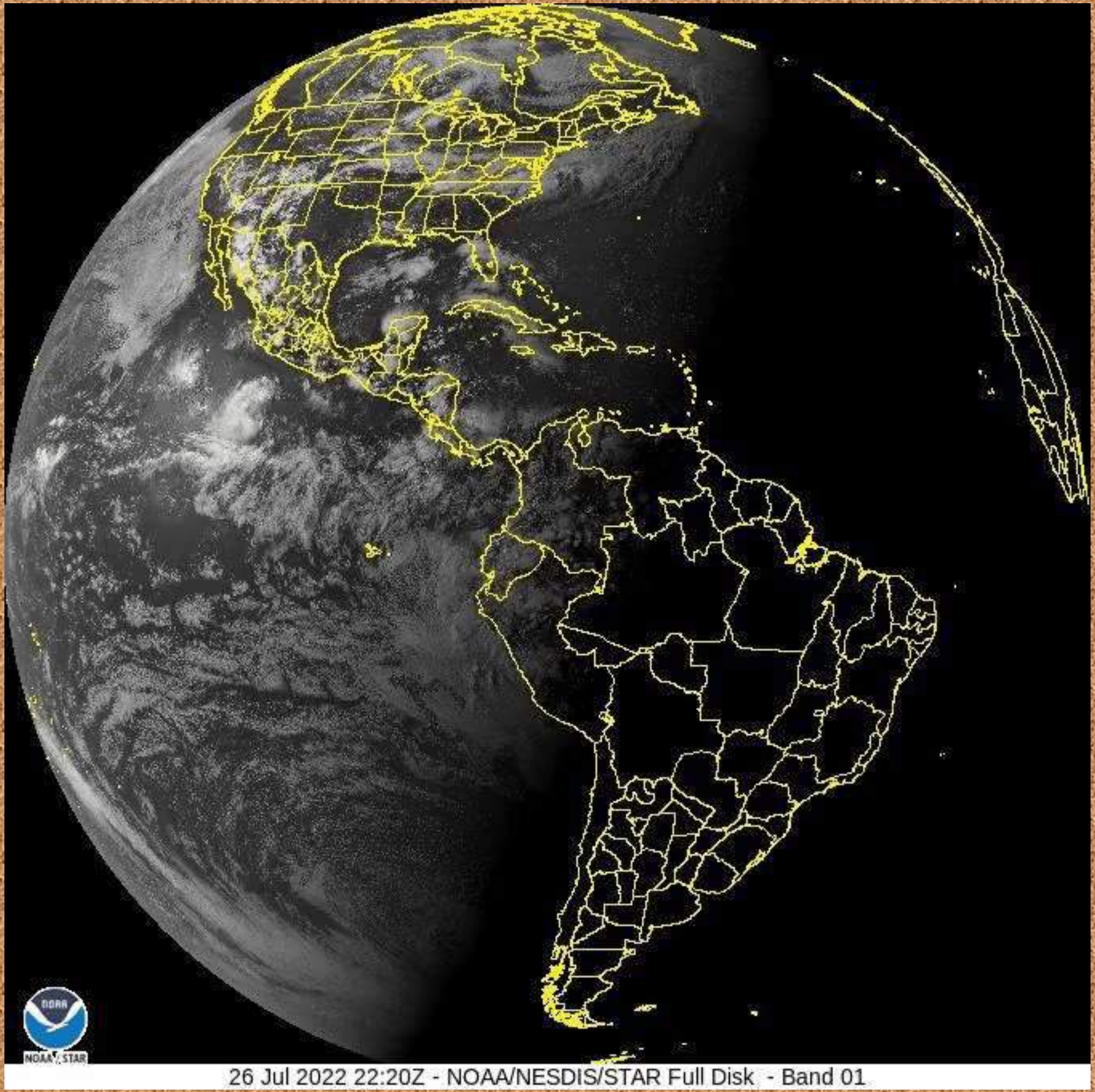
Lagrange Orbit?



Low Orbit?

Geo Orbit?

Lagrange Orbit?



Low Orbit?

Geo Orbit?

Lagrange Orbit?

DSCOVR
Credit: NASA

Low Orbit?

Geo Orbit?

Lagrange Orbit?

Fredric
Raab
AMSAT
CubeSat
Simulator

John
Moore
A3Sat
Project

Lucas
Moxey
TechRise

CubeSats

Connecting to the Next Generation Science Standards

The lessons and activities outlined in this module are one step in the learning progression toward reaching the performance expectations listed below. Additional supporting lessons and activities will be required.

Specific connections between the performance expectations, three dimensions, and classroom activities are articulated at the beginning of every lesson.

Important Note

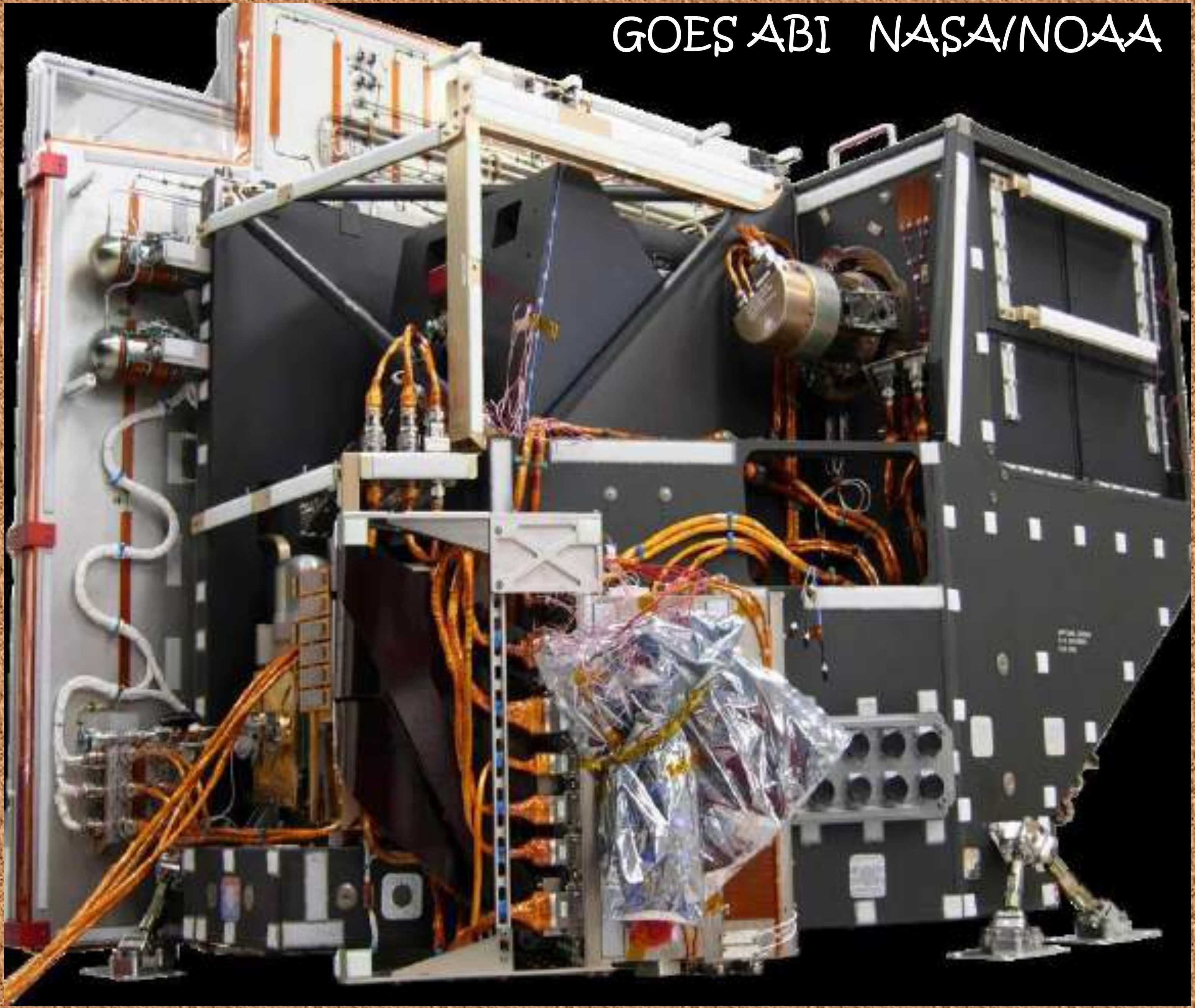
The grade level and associated performance expectations, disciplinary core ideas, science and engineering practices, and crosscutting concepts identified throughout the module were selected to align with the Next Generation Science Standards. In classrooms using local or state standards, this module may fall within a different grade band and may address different standards. Teachers should adapt this module to meet local and state needs.

Furthermore, teachers should adapt the module to extend student learning to additional grade levels, performance expectations, disciplinary core ideas, science and engineering practices, and crosscutting concepts to meet student needs.

Performance Expectations
The lessons and activities in this module contribute toward building understanding of the following *engineering* performance expectations: 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. **The lessons and activities in this module contribute toward building understanding of the following *physical science* performance expectations:** 5-PS2-1. Support and argument that the gravitational force exerted by the Earth on objects is directed down.

Dimension	NGSS Element
Science and Engineering Practices	**Asking Questions and Defining Problems** • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. **Developing and Using Models** • Develop and/or use models to describe and/or predict phenomena. **Planning and Carrying Out Investigations** • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials is considered. • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. • Use evidence to construct or support an explanation or design a solution to a problem. **Engaging in Argument from Evidence** • Support an argument with evidence, data, or a model.
Disciplinary Core Ideas	**ETS1.A: Defining and Delimiting Engineering Problems** • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success of how well each takes the constraints into account. **ETS1.B: Developing Possible Solutions** • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. • Tests are often designed to identify failure points or difficulties, which suggest the elements of a design that need to be improved. **ETS1.C: Optimizing the Design Solution** • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. **PS2.B: Types of Interactions** • The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.
Crosscutting Concepts	**Influence of Science, Engineering, and Technology on Society and the Natural World** • Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. **Cause and Effect** • Cause-and-effect relationships are routinely identified, tested, and used to explain change.

Teaching Channel CUBESATS Teach Handbook


GOES ABI NASA/NOAA

PALEONTOLOGICAL
RESEARCH INSTITUTION

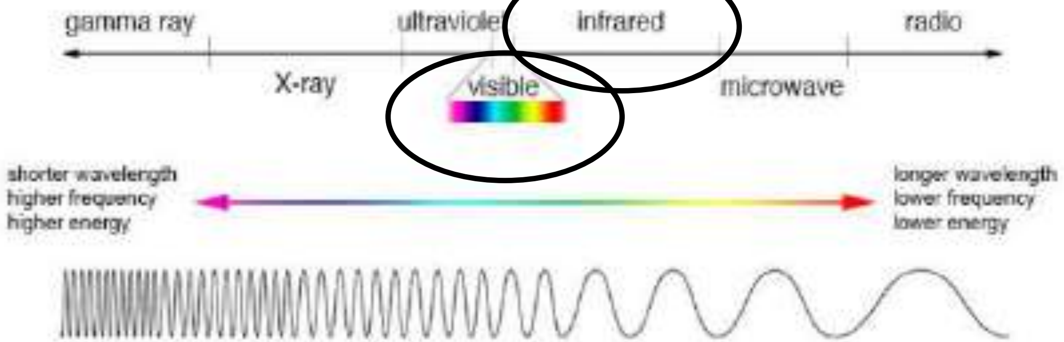
The Teacher-Friendly Guide to Climate Change

Climate Change Toolkit
Infrared Energy

<u>Standards</u>
NGSS ESS3.D Global climate change
NGSS PS4.B Electromagnetic radiation
Grade Level: Middle School

<u>Equipment</u>
Infrared camera
8x10" picture frames (4)
8x10" sheet of black plastic (1), clear plastic (1), glass (1)
Optional: microwave oven and glass or ceramic mug with handle

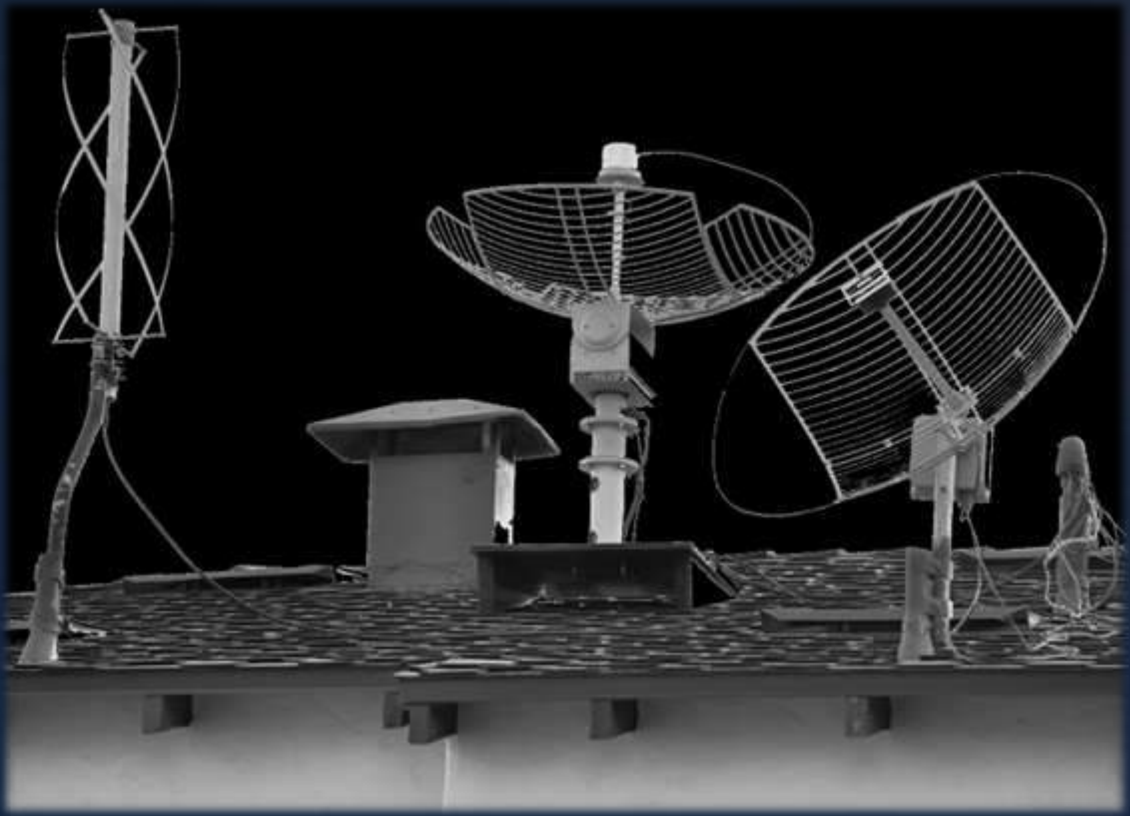
Overview
Energy is characterized by its wavelength. The electromagnetic spectrum maps out a range of energies from very short wavelength gamma rays ($< 10^{-12}$ meters) to very long wavelength radio waves (1millimeter to 100 kilometers). Near the middle of this spectrum is the visible light that we are most familiar with. Human eyes are energy detectors that are tuned to the wavelengths of the visible spectrum (390 to 750 nanometers). While our eyes do not detect energy of shorter or longer wavelengths we know how to build detectors to do just that. A standard "ear thermometer" that you might use to determine if a child has a fever is a detector of infrared energy.

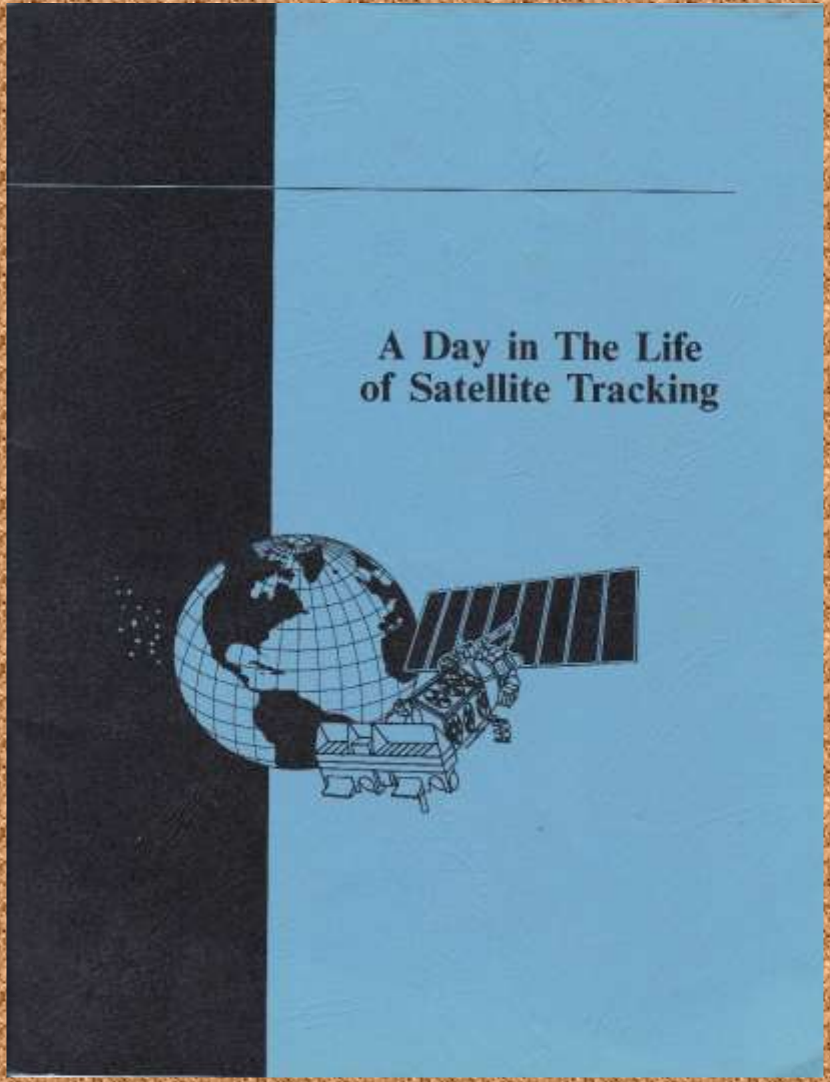


https://teachclimatescience.files.wordpress.com/

GOES S

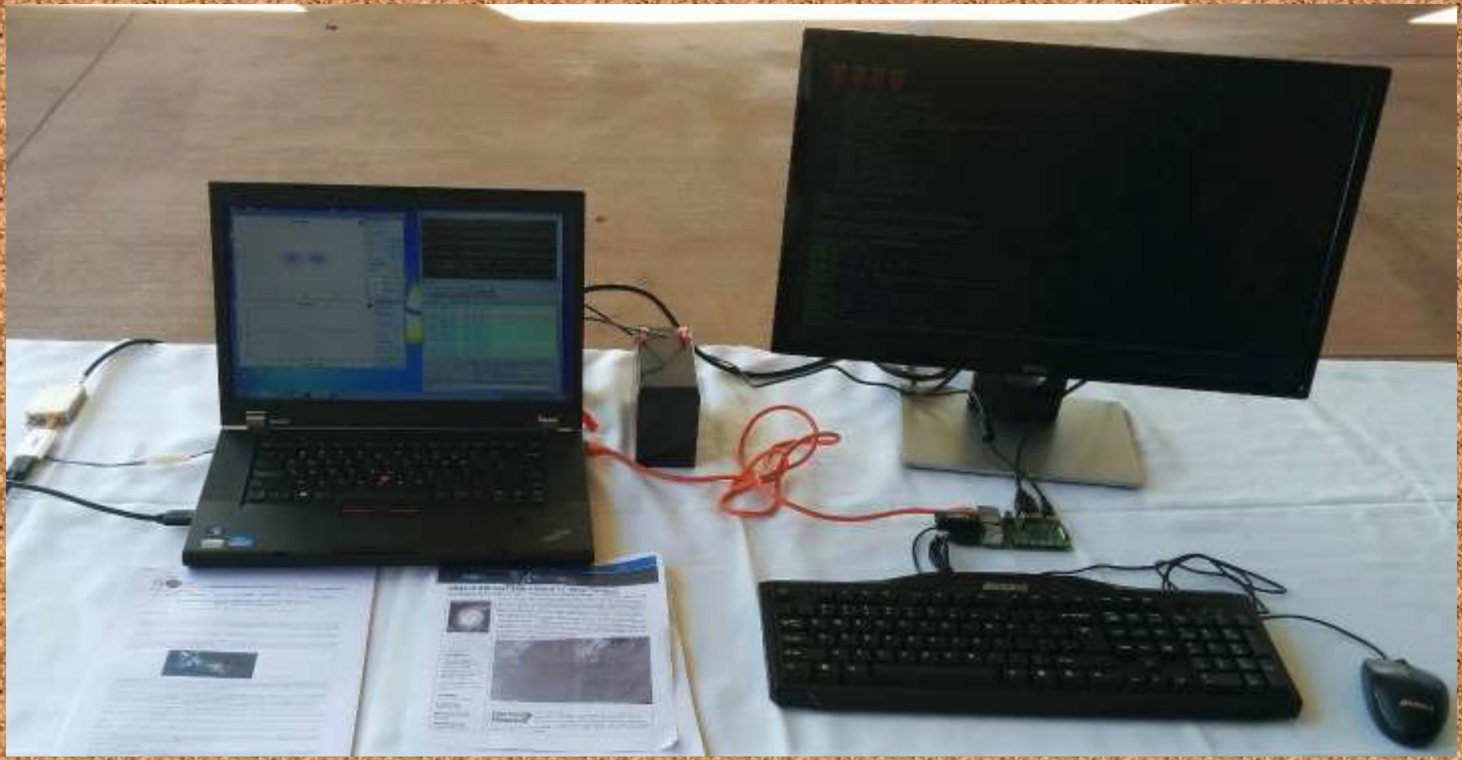
NASA/NOAA




A Day in The Life
of Satellite Tracking


LA
PUENTE
HIGH
SCHOOL



Thank You

Volunteers
Audience
Teachers Who Inspire

Now let's head outside