Science Module

This science module focuses on the launch and propulsion of the Genesis spacecraft. If you are using Genesis science modules for the first time, read the User's Guide thoroughly before you begin. *(View User's Guide as PDF)*.

The following classroom materials are available in Portable Document Format (PDF) for your browsing and printing convenience. The files are print-optimized, and should be printed to achieve maximum resolution. Adobe's new **Acrobat Reader 4.0 is required** to view and/or print. To install the FREE reader, visit the Adobe Web site.

Take a look at additional science modules that are available on the Genesis Web site. All technical terms in the science modules are compiled in the Glossary for easy access.

Some materials in this module require QuickTime to access. Download the free player here.

Dynamic Design: Launch and Propulsion

In *Dynamic Design: Launch and Propulsion*, students become familiar with how rockets are launched. Students will also learn how and why specific rockets are chosen for varying payloads. In this middle school module (grades 5-9), students learn about the history of rocketry and work with variables that might affect the performance of a launch vehicle. Students work in teams to investigate one variable, in detail, by performing tests. By completing these tests they will learn the various aspects of launching a rocket. In the assessment, students engage in a competition whereby they apply what they have learned about rockets to build a launch vehicle that flies as high as possible.

Instructional materials for this phase are incorporated into Exploration activities below.

Briefing

The module begins by having students look at the concept of variables. In "Pop Rocket Variables," students investigate a simple rocket made with antacid and a film canister. Students begin by listing all of the variables that might affect the performance of the pop rocket, then operationally define these variables. Finally, students design a test where they investigate changing one variable and keeping the others constant.

The Student Text "Variables and Operational Definitions" provides students with background on these process skills, while "I Can't Believe I Ate the Whole Thing" provides background information on antacid and heartburn.

Module Planning Guide

Pop Rocket Variables
- Teacher Guide
- Student Activity
- Student Handout

Variables and Operational Definitions
- Student Text

I Can't Believe I Ate the Whole Thing
- Student Text

Pop Goes Newton
- Teacher Guide
- Student Activity

Newton's Laws of Motion and Rockets
- Student Text

The History of Rocketry
- Teacher Guide
- Student Activity

Exploration

In the activities of this module, the teacher's primary role is Socratic. Through effective questioning, students should become aware of Newton's laws of motion as they apply to rockets.

In the Student Activity, "Pop Goes Newton," students continue to study the concept of variables in relation to launching pop rockets. The lesson has the students applying each of Newton's laws to the pop rocket activity.

Students chart a two-tiered timeline in the Student Activity, "The History of Rocketry." They note key developments in rocketry on one line and what happened in society at the same time on the other line.

Curriculum Connections

National Standards Addressed

Grades 5-8

Science as Inquiry
- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Physical Science
- Properties and changes of properties in matter
- Motions and Forces
- Interactions of Matter and Energy

Science and Technology
- Understandings about Science and Technology
- Abilities of Technological Design

History and Nature of Science
- History of Science

Science in Personal and Social Perspectives
- Science, Technology and Society
- Personal Health

Additionally in Grades 9-12

Physical Science
- Structure and Properties of Matter
- Chemical Reactions

History and Nature of Science
- Historical Perspectives

Science in Personal and Social Perspectives
- Personal and Community Health

Student Mission

Students will work in teams to learn about various aspects of launching a water rocket. Students work in expert groups to learn more about variables related to propulsion, the shape, size, number and placement of fins and the nosecone shape. Students then take the information learned in the expert groups back to their design group to design and build a water rocket that will fly as high as possible.

Launching Genesis
- Teacher Guide

Choosing a Launch Vehicle
- Student Activity

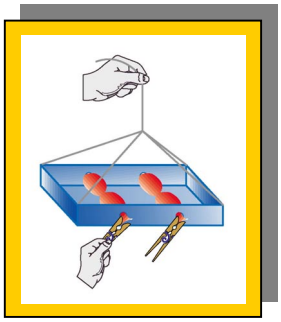
How Do You Spell Success?
- Student Activity

Genesis Launch Vehicle: The Delta Rocket
- Student Text

Propulsion
- Student Activity
- Teacher Text

Development

Use the student activities in "Launching Genesis" to create interest in learning more about the launch and propulsion of the Genesis spacecraft. In "Choosing a Launch Vehicle," students look at the launch vehicle requirements for the Genesis spacecraft. They then decide which rocket should be chosen from a list of several Delta rockets. Through a simulation, students learn about the propulsion system on the Genesis spacecraft. "Genesis Launch Vehicle: The Delta Rocket" is a text that explains the history of the Delta rocket from its inception in the late 1950's to its use today in launching satellites with information specific to the launch of Genesis. Students calculate the success rate of the Delta rocket in the Student Activity "How Do You Spell Success?" The "Propulsion" teacher text describes various propulsion systems ranging from what is used by the squid to the hydrazine system on Genesis. Future advanced propulsion systems are also explored in this text.



Investigating Water Rockets
- Teacher Guide
- Appendix A: Safety Rules
- Appendix B: Safety Checklist
- Appendix C: Nosecone Patterns

You Get What You Pay For
- Teacher Guide
- Student Activity

Measuring Altitude
- Student Activity

What a Drag
- Student Activity

Altitude vs. Water Volume
- Student Activity

Altitude vs. Water Pressure
- Student Activity

Fly Like an Eagle
- Student Activity

Flying Straight
- Student Activity

Investigating Fin Shape or Size
- Student Activity

Investigating Fin Number and Placement
- Student Activity

Weather or Not
- Student Activity

Interaction/Synthesis

In this phase of the learning cycle, student/peer interactions are emphasized. These activities contain work to be done in expert groups, with the whole class participating in the safety rules found in the Appendices. Once students have had time to explore the rocket variables in these activities, they return to their original design groups to build and test their water rockets.

Fly Me High
- Teacher Guide
- Student Activity

Assessment

In the assessment activity, "Fly Me High," students are asked to combine what they have learned in this module with the skills needed to launch a water rocket to as high an altitude as possible. In the optional activity "You Get What You Pay For," students are responsible for building a budget for the activities undertaken in both the Interaction/Synthesis and Assessment sections of this module.

Curriculum Connections

National Standards Addressed

Assessment Standard B
- Achievement and Opportunity to Learn Science must be Assessed

Assessment Standard C
- Assessment Tasks Are Authentic

TEACHER RESOURCES

- **For a concise overview on rocketry, view this one-page fact sheet**
- **View a listing of additional resources that includes URLs, books, and periodicals.**

This education module, *Dynamic Design: Launch and Propulsion,* was developed by educators at Mid-continent Research for Education and Learning.

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Special thanks to Genesis Mission Integration Manager Kristen Walsh at Boeing, for her interview on conducting a launch campaign and launching a Delta Rocket.

Special thanks to the McREL Eisenhower Regional Consortium for Mathematics and Science, and the following consultants:
Deb Jordan, Nebraska and South Dakota Liaison, McREL
Dr. Martha Henry, Missouri Liaison, McREL

Special thanks to the following reviewers:
Dr. Gil Yanow, Jet Propulsion Laboratory
Dr. Dean Eppler, NASA Johnson Space Center
Mark Rose, Maplewood Junior/Senior High, PA
Dr. Donna Bogner, McREL
Jacinta Behne, McREL
Pat McCartney, McREL

Special thanks to the X-Prize Foundation, and the materials developed for the Eggs-Prize curriculum [http://www.xprize.org/~Xprize/education/].