

**Understanding aerospace through ...**



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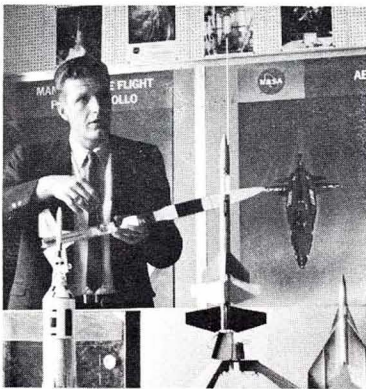
# ... Model Rocketry

**Let your students "discover" the exciting world of Aerospace Science . . . with unsurpassed meaning and effectiveness.**

## A NEW EDUCATIONAL TOOL

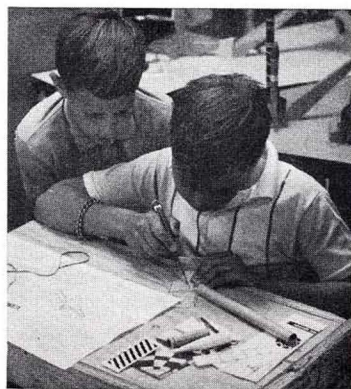
After much testing over the past ten years, Model Rocketry has proven to be a safe, meaningful and motivating educational activity. Participating in Model Rocketry allows you and your students to actually "see" and "feel" the principles relating to rocket propulsion, aerodynamics, space physics, math, and countless other science fields.

With Model Rocketry, you actually design, build, launch, and experiment with materials proven safe and reliable through over 20 million launchings. Encouraged by NASA and the National Science Teachers Association, model rocketry is now being profitably used in hundreds of elementary and secondary schools throughout the country.



## AEROSPACE EDUCATION

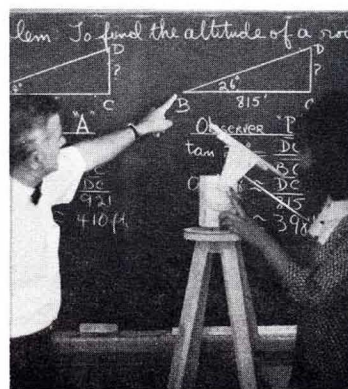
This title represents a new curricular offering in many schools across the country. Basically, it is a general education program that deals with aviation and their influence on our society. The model rocket plays a major role in many of these programs because it provides students with a realistic and practical way of studying both aeronautics (the science of flight within our atmosphere) and astronautics (the science of flight beyond the atmosphere - in outer space).



## STUDYING AND MODELING

Students enjoy studying about rockets and rocketry and often use the subject for written and/or oral reports. Students can learn how to organize research material and prepare reports of a technical nature while studying Model Rocketry.

Modeling provides a practical situation for involving students in the use of their hands. And, when a student builds a model rocket he is building something that is of interest to him.



## MATHEMATICS

After you have used some mathematics to explain why rockets perform as they do, your students will begin to realize that mathematics can be useful . . . Algebra can be used to explain basic relationships such as distance, rate, and time. Trigonometry can be used to determine the altitudes achieved by the rockets. Investigating the Total Impulse curve and refining distance, time and rate relationships can serve to introduce the basics of Calculus.



## BIOLOGY

Sooner or later Model Rocketry students desire to launch a mouse to check the "biological effects" of acceleration. Although this is exciting for students and newspaper photographers, the scientific value of the "experiment" is questionable. For this reason, we recommend the launching of a raw egg to check students on the proper handling of payloads. This can be followed up by teaching a unit on the biological effects of man in flight, in the air and in Space.

## VERSATILE

Because the subject of "Rocketry" involves nearly all of the sciences, the model rocket has recently become a popular teaching tool. One can hardly begin to study this subject without "discovering" and "experiencing" other lessons in such related fields as:

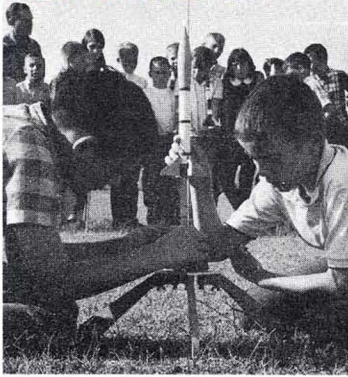
|              |               |                |
|--------------|---------------|----------------|
| Astronautics | Space Biology | Aeronautics    |
| Astronomy    | Meteorology   | Aerodynamics   |
| Navigation   | Mathematics   | Communications |

In addition, the students experience practice in model craftsmanship, communications and group dynamics as extra benefits of this activity.

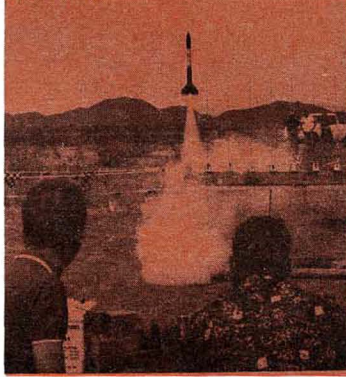
The "simplicity" or "complexity" of Model Rocketry can be easily geared to any grade level from grades 3 to 12. Centuri's up-to-date guidebooks and technical reports will assist you in fashioning the appropriate course of study.



## PREPARING TO LAUNCH



## LIFT-OFF



## CHALLENGING & MOTIVATING

When a student finishes building a model rocket, he is swelling with pride . . . and after his model has "lifted off", rocketed skyward, and returned safely to Earth, you will see within him a thrilling excitement that awaits your guidance. If you have never had highly motivated students, try Model Rocketry . . . you will be challenged anew.

## DYNAMIC

A model rocket launching with altitude tracking and recovery offers the teacher many opportunities to involve students in a cooperative adventure in accomplishing a particular goal. It provides a situation in which a teacher can involve all of the students at one time.

The launching provides an excellent opportunity for students to experience success and to develop a sense of pride in their accomplishment. Altitude tracking gives students a chance to discover the usefulness and excitement of the mathematics they've been studying and to apply it meaningfully.

## TRACKING

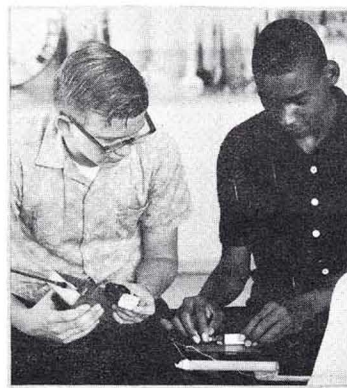
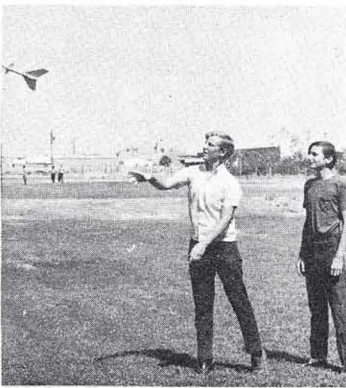


## RECOVERY



Model Rocketry Programs for all grade levels:

- Elementary
- Junior High
- High School
- College



## PHYSICAL SCIENCE

Teachers of Physical Science courses use Model Rocketry to develop "dynamic" units. If students are studying about motion, why not let them work with something that moves? Concepts such as distance, velocity, acceleration, momentum, Newton's laws of motion and gravitation, the four aerodynamic forces (thrust, drag, lift, gravity), Bernoulli's principle, the elements of propulsion, etc. are easier to comprehend when students can get involved with what they are studying.

## RESEARCH AND DEVELOPMENT

Students can experiment and actually carry out meaningful research with model rockets (e.g., various rocket designs, using different fin and body shapes, can be flown and performance compared to demonstrate stability and air drag effects). Teachers have also found Model Rocketry perfect for teaching the fundamental principles of the Scientific Method. The advantages and disadvantages of mathematical and experimental methods can also be demonstrated.

## STUDENT PROJECTS

Because many areas of learning can be incorporated into Model Rocketry, a variety of projects are possible (e.g., electronic components, wind tunnels, meteorological instruments, etc.). Many of these projects make excellent Science Fair entries. Students also enjoy competing against one another in the many Model Rocketry competition events (e.g., parachute duration, boost/glider duration, payload events, altitude events, etc.). Model Rocketry has unlimited possibilities!

## WHERE DO YOU BEGIN?

Why not begin by actually launching a model rocket? The launching will provide a meaningful and motivating experience for your students. It will stimulate their curiosity and allow you to introduce your subject in an interesting manner. For the complete story on Model Rocketry and its Educational advantages, order your copy of Centuri's Educator Guide now. Also, examine the Centuri supplies catalog to see for yourself the wide variety of high quality rocket kits, engines, and parts available.



## MODEL ROCKETRY EQUIPMENT

Shown here are a grouping of model rocketry materials especially selected for their education and demonstrative value. They are ideally suited to start your class or club off right in their studies of rocketry and related sciences.

Use model rocketry as a motivation . . . an effective lead-in to a study section on Space Sciences, Rockets, Space Travel, Aerodynamics, or even basic Trigonometry. Use for indoor and outdoor demonstrations, science projects, or individual arts projects. Conduct actual launching demonstrations yourself or assign to student teams. Simple enough for students to assemble and operate.

All Centuri products are safety proven and meet the standards of the National Association of Rocketry (NAR), the Federal Aviation Agency, the National Fire Protection Association, and the Federal Food and Drug Administration.



See thrilling rocket flights to 1,800 feet with spectacular parachute recovery. Launch them over and over again,

### CLASSROOM AND LAUNCH DEMONSTRATION OUTFIT

An excellent demonstration outfit for students of all grade levels. It includes the three basic types of rockets . . . single-stage, payload, and multi-stage. Plus, it includes the necessary basic launching and firing system which lets you launch many more types of model rockets shown in Centuri's catalog.

With the twelve rocket engines included, you can launch each rocket three times. Launch many more times by ordering extra engine packs. (see below) Wide range of engine power allows you to launch from 100 feet up to 1,800 feet altitude. All rockets return safely and gently by colorful parachute. Operating instructions included.

#### OUTFIT INCLUDES:

Javelin Single Stage Rocket Kit  
Payloader-2 Carrier Rocket Kit  
Arcon-Hi 2-stage Rocket Kit  
Heavy Duty Launcher  
Lectra-Line 2 Firing Panel  
12 Assorted Rocket Engines & Igniters  
Information Packed Handbook

#### DEMONSTRATION OUTFIT

Catalog No. SK-102

#### EXTRA ENGINE PAK

12 Assorted Power Range Rocket Engines  
Catalog No. SK 102-12 E





### MODEL ROCKET ENGINES

The "heart" of Centuri's model rocketry program. These compact, reliable, energetic engines (about the size of a roll of dimes) provide the "thrust" power to propel these lightweight models. Ignited electrically, these "miniatures" operate exactly like large solid propellant rockets. Safety certified and approved by the National Association of Rocketry.



### MODEL ROCKET ENGINE CUTAWAY DISPLAY

Three-dimensional molded plastic cut-away mock-up of a model rocket engine. 3½ times actual size. Shows all the inner parts of the engine. Even has actual engine label on back side. Comes with die cut display card which explains function of each engine component. Comes in kit form with die cut pressure color labels.

Catalog No. KE-7



### MODEL ROCKET TOOL KIT

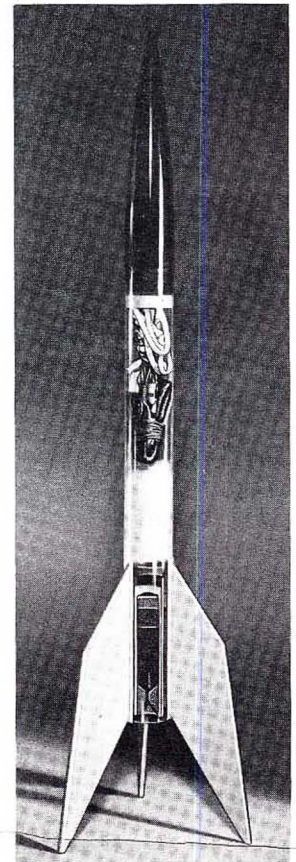
A complete set of modeling tools helpful in construction of model rockets, all packed in an attractive vinyl carrying case. Share tools among students. Includes: 1 fine blade cutting knife, 1 heavy duty knife & blade, 5 extra blades, 1-¾" wide razor saw, 1-2" wide sanding block, and 1-6" steel ruler.

Catalog No. XC-90

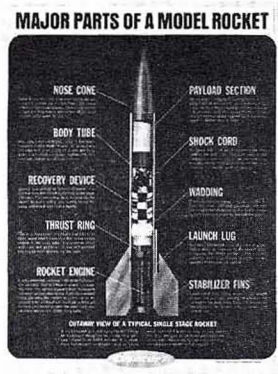
### THE "VISIBLE ASTRO" ROCKET KIT

A completely see-thru plastic version of Centuri's famous ASTRO-1 rocket. It's easy-to-assemble and the "VISIBLE ASTRO" clearly shows all the "insides" of a model rocket including the rocket motor, engine mount, parachute, and chute wadding. For display only. Not to be launched.

Catalog No. KC-10



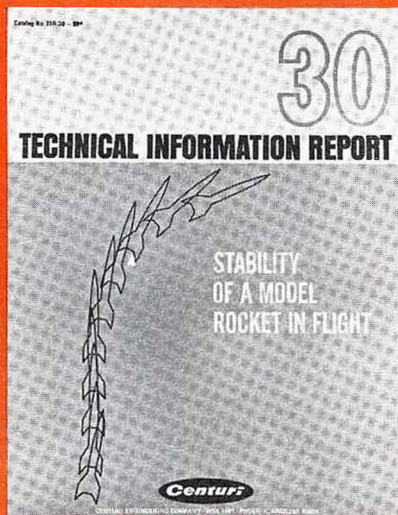




### MODEL ROCKETRY WALL CHART SET

Large, attractive 17" x 22" wall posters for your classroom or clubroom. A quick glance will show you "Major Parts of a Model Rocket", "How Does a Model Rocket Work?", "How Model Rocket Engines Work" and the "Model Rocketeer's Safety Code". Printed in two colors on fine quality bristol stock.

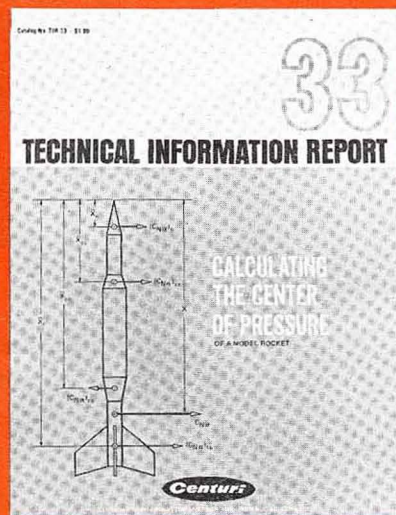
Catalog No. WC-4



#### T.I.R.-30

What makes a rocket fly straight? You may have heard that a "stable" rocket is one in which the "center of pressure" is behind the "center of gravity". What does this mean? What is "center of pressure"? How do you find it? What is "stability"? Are there any simple tests to tell if a new rocket will be stable? Find the answer to these and many other questions in TIR-30. Loaded with illustrations. Written for grades 7 and up. 16 pages.

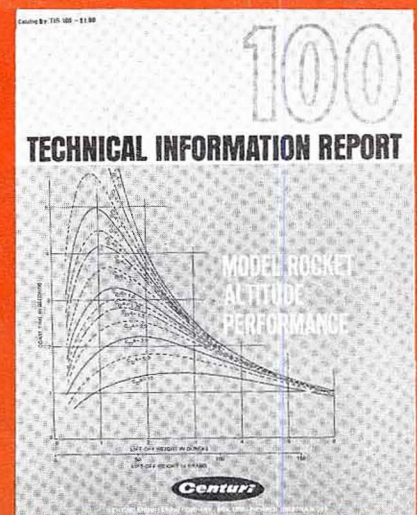
Catalog No. TIR-30



#### T.I.R.-33

Once your students have learned the whys and wherefores of "stability" in TIR-30, they will be ready to use this report. This clearly presented report shows you how to locate the exact center-of-pressure so you can obtain maximum altitude with an adequate margin of stability. Extremely helpful illustrations, equations, and charts useful in designing rockets. Written for grades 8 and up. 36 pages.

Catalog No. TIR-33



#### T.I.R.-100

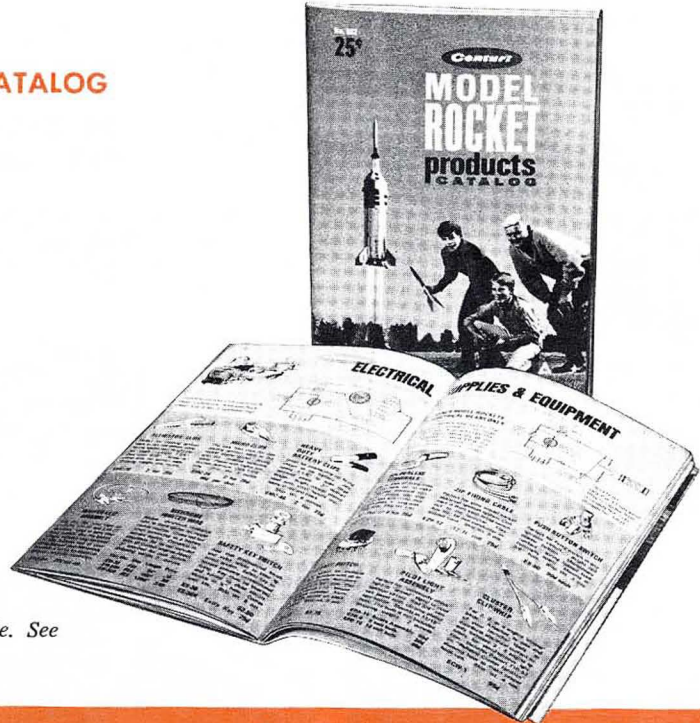
Learn to predict the peak altitudes achievable by single stage rockets using any of the Centuri (1/2A thru F) rocket engines with easy-to-use graphs. Also use graphs to select the ideal engine delay time. No math calculations needed. These computer plotted graphs plus clearly written text will help the student understand how engine thrust, rocket weight, and aerodynamic drag on various nose and body shapes are interrelated in their effects on performance. A valuable design reference. Grade 9 and up. 52 pages.

Catalog No. TIR-100

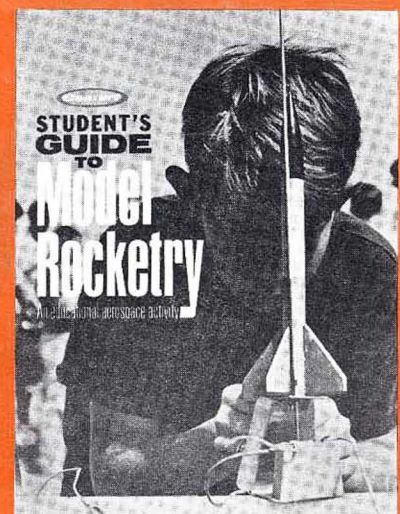
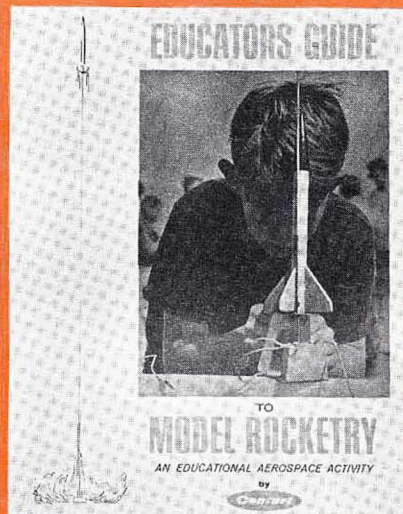
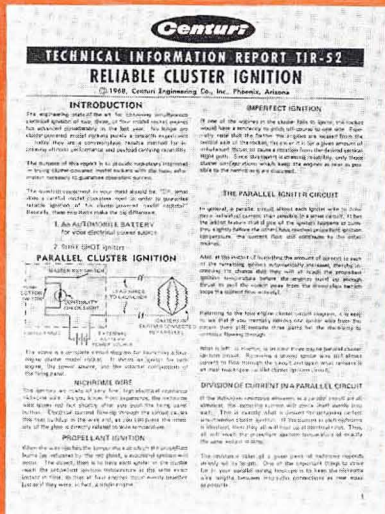


# Centuri MODEL ROCKET PRODUCTS CATALOG

Centuri Engineering Co., a pioneer and innovator in the field of Model Rocketry, offers its full line of products through a big, colorful catalog. Included are over 40 different rocket kits, launchers, firing panels, 35 different rocket engine types, custom building rocket parts, finishing materials, and tracking equipment. To add further dimension to your model rocketry program, ask for your free Centuri catalog.



Special quantity discounts available. See separate price sheets.



## T.I.R.-52

Reliable, simultaneous electrical ignition of "clustered" model rocket engines is vital for maximum performance and stable flight. The technique of "clustering" engines for higher lift-off thrust is now made easy. This well illustrated report explains the "whys" and "hows" in obtaining reliable electrical ignition of 2 or more engines in a cluster. TIR-52 shows how to select the best power source and wire up igniters for a successful cluster launch every time. Written for grades 7 and up.

Catalog No. TIR-52

## EDUCATOR'S GUIDE

An excellent introduction to this fascinating and educational activity called "Model Rocketry". In 60 pages, it explains the basic essentials to setting up a rewarding model rocketry program for your students or club. Explains how model rockets work, plus guidance, stability, ignition, recovery, tracking, and competition. Use as a teaching guide together with the coordinated Students Guide, shown to the right. Includes numerous examinations plus answer key.

Catalog No. EG-40

## STUDENT'S GUIDE

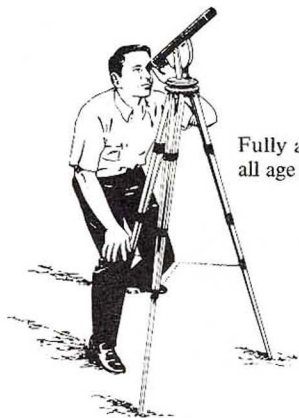
An excellent beginning introduction and continuing guidebook to Model Rocketry. Covers the following subjects of interest:

- What is a Model Rocket?
- How the Model Rocket Works.
- Rocket Design and Performance
- Guidance and Stability
- Launching and Recovery Systems
- Rocket Plans and Assembly Steps
- Altitude Tracking and Range Set-up
- Model Rocketry Competition

Catalog No. TB-10







Fully adjustable to fit all age groups.



An ideal low cost instrument for beginning "surveying" or civil engineering students. Perfect for demonstrating functions and useful applications of Trigonometry.

## ROCKET ALTITUDE TRACKING OUTFIT

One of the first questions asked by nearly everyone who participates in Model Rocketry is: "Can you determine how high your rockets go?" The answer is "yes", . . . and quite accurately too. With the SKY-TRAK, your students can track the rockets to their maximum heights and then determine the exact altitude achieved to within  $\pm 5\%$ . At the same time, the students will experience an appreciation for the trigonometry involved in finding altitudes.

Use one or two trackers. One will give you the approximate altitude; two will provide quite accurate altitudes. By using the SKY-TRAK along with the "Altitude Computer" and the "Flight Data Sheets" included with each tracker, your students will learn coordination between the tracking and the data reduction instruments. Student teams are ideal for operation of the "tracking system".

1. Sky-Trak Catalog No. ALT-1
2. Sky-Trak Catalog No. ALT-2



### ALTITUDE COMPUTER

Using the "elevation" and "azimuth" readings obtained from either one or two Sky-Traks, the student can compute the altitude reached by his rocket quickly and accurately . . . with practice, in less than 30 seconds. A motivating and useful lesson in basic trigonometry. Big 17" x 22" chart with plastic beam arms. Comes with Altitude Tracking Report and 10 Flight Data Sheets.

Catalog No. ALC-1



### FLIGHT DATA SHEETS

Maintain permanent records, including complete rocket and engine description plus flight results. Teaches importance of accurate data recording and permits comparison of various rocket flights. Each sheet is printed on both sides and includes simplified diagrams and equations for computing altitudes using the SKY-TRAK trackers. Comes in pads of 10 sheets . . . 8½" x 11" standard size.

Catalog No. FDS-10

*Model Rocketry is a motivating, educational activity. It offers teachers and students a chance to build, launch, and experiment . . . safely. Model Rocketry is recognized by the National Aeronautics and Space Administration and the National Science Teachers Association.*



**CENTURI ENGINEERING COMPANY**  
P. O. Box 1988 Phoenix, Arizona 85001

*Model Rocketry is increasingly being used as an interesting and visual adjunct to the subjects of mathematics, physics and general science classes in schools of all levels throughout the country.*