SEPTEMBER 1958

How We'll Steer in Space

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SEPTEMBER 1958 POPULAR MECHANICS

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SEPTEMBER 1958
WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 110 NO. 3

THESE ROCKETEERS PLAY SAFE

By Joseph E. Brown

WHEN SATELLITES started beeping overhead, thousands of youngsters all over the country launched themselves into a new hobby — rocketry — with or without parental permission.

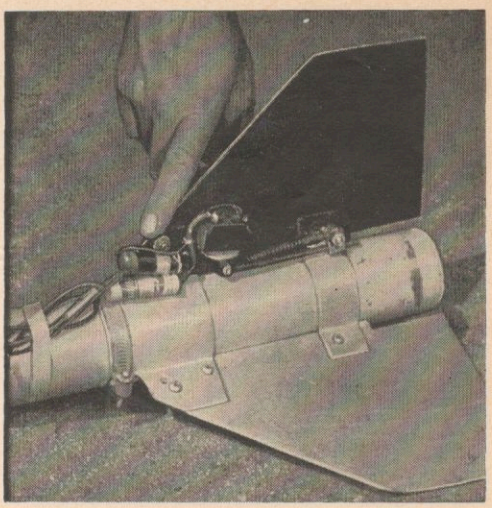
No doubt about it, amateur rocketry can be extremely dangerous. But rocket clubs which have been in existence for years prove that it also can be reasonably safe—if rigid rules are enforced. Safety precautions, teen-agers have found, don't cut down on the fun; they just cut down on the accidents.

Take a look at a supervised firing of an amateur rocket:

From a steel launching tower anchored

Teen-age rocketeer loads his four-foot rocket on the 10-foot launching stand in the Mojave Desert

Young member proudly shows rockets he designed. After fueling, the rockets are stored in shed, below



Ingenious mechanism arms the second and third stages of a three-stage rocket as the first stage falls away

to the floor of California's sprawling Mojave Desert, a silvery rocket vaults into the sky, its yellowish smoke trailing behind to mingle with the sagebrush.

Inside a concrete-block building, a tape recorder feels the rocket's heartbeat. Two men, wearing short-wave-radio headsets, wait for reports from tracking teams scattered in the brush. The rocket reaches its summit, hesitates, plunges earthward at 500 miles per hour.

A thousand feet from the launching pad, a crowd huddles in slit trenches behind thick earthen barricades. Earlier, before the missile was triggered by remote control from the safety of the blockhouse, a siren had wailed, a red flag fluttered, a light flashed and a loudspeaker blared intermittent warnings.

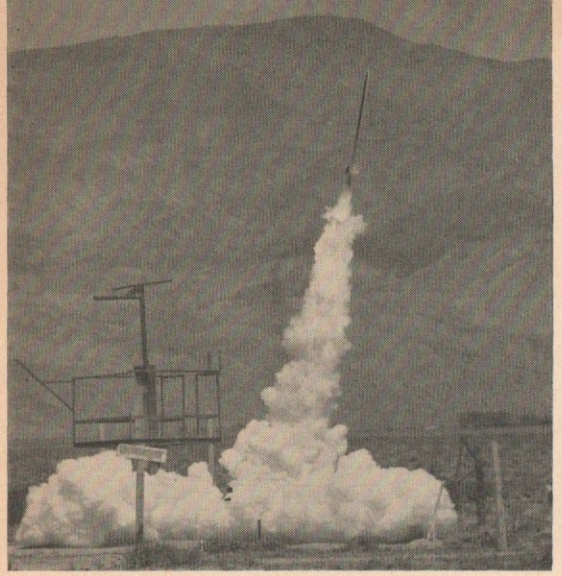
The occasion was the annual public firing of the Reaction Research Society of Glendale, Calif., one of the United States' two major nonprofessional rocket groups and an organization which is gaining new members every week.

Societies Promote Safety

The elaborate launching precautions — the siren, red light, flag, trenches and loudspeaker—are examples of how far the RRS and its sister societies have gone to promote safety in the field of amateur rocketry.

Since the RRS was organized 15 years ago in southern California, more than 300 rockets have been static tested and fired into flight. Yet the society's accident record in that period is without a blemish.

Unfortunately, all amateurs cannot boast such a record. Back-yard rocketry has bloomed everywhere in the United States. Garages have become rocket-building



Pay-off question after months of labor: Will it work? Here a homemade rocket blasts off in successful test

Full safety precautions are observed during the critical period when the solid fuel is tamped into place

shops; science classrooms have taken on a space-laboratory air, and homemade missiles are shooting skyward from vacant lots.

And So, the Inevitable

With this burst of amateur interest in space, the inevitable has happened. In Texas, a homemade rocket fashioned from water pipe and stuffed with match heads blew up, permanently disfiguring its 14-year-old builder. Two youngsters in New England suffered near-fatal burns when a "dead" rocket reignited. Across the country, safety organizations began demanding action.

Connecticut banned amateur rocketry altogether. Other groups, such as the National Fire Protective Association of Boston, urged laws on a nationwide scale to curb such tragedies.

Firings Without Mishaps

Yet today, in the vast open spaces of the West, future scientists banded in groups such as the RRS are firing dozens of rockets every year—within the law—without serious mishap.

The secret?

Supervision, a strict set of rules, and constant enforcement of these rules.

Spectators and cameramen observe launchings behind earthen barricades. The society reserves the right to remove any individual from the test area

Rocket takes off in perfect test as RRS officials watch from safety of blockhouse 40 feet from launching stand

POLICY TO BE FOLLOWED AT PUBLIC LAUNCHINGS

REACTION RESEARCH SOCIETY REGULATIONS

The Executive Council of the Reaction Research Society has adopted the following policy to be followed at public launchings.

1. No rocket will be fired unless everyone is behind shelter.
2. Only the recovery crew will be allowed in the impact area between firings to find and flag the rocket.
3. The public will be allowed to go into the impact area to observe and photograph the downed rockets only at specified times.
4. The public will not be allowed in the fenced area except at the discretion of those responsible for the firing.
5. No alcoholic beverages will be allowed inside the test area.
6. No firearms will be allowed inside the test area.

FIRING PROCEDURE

1. PREPARATIONS: Signal, green flag. Spectators may witness and take pictures of activities but must stay clear of fenced areas.
2. COMMENCE LOADING: Signals, yellow flag, one blast of siren. All persons not engaged in the test must return to the sheltered area.
3. ARMING: Signals, red flag, two blasts of siren. All personnel must be in protected area. The rocket is ready to be fired.
4. X MINUS ONE MINUTE: Start of countdown.
5. 15-SECOND WARNING: Siren and flashing red light. All persons must be behind protective cover during flight.
6. FIRE: All persons must remain behind protective cover during firing and be prepared to move to better cover in case of erratic flight.
7. In case of misfire or delay there will be an intermittent blast of the siren. All persons are to remain where they are and instructions will be given over the public address system.

We demand the cooperation of all visitors in observing these regulations and reserve the right to remove any individual from the area.

RRS President Calvin VanWagner, a semiprofessional rocketeer at 18, puts it this way:

"We *live* safety. There's always an element of danger in rocketry—amateur or professional—but we can at least minimize that danger. We hope to keep groups like the RRS going for a long time.

"At the same time," he adds, "we're trying to discourage the type of amateur rocketry that's given us a bad name."

Safety is written into the bylaws of the California society and carried out to the letter during the periodic private launchings and once-a-year public firings on a 40-acre site leased from the federal government.

RRS rockets range from two and three-inch bulletlike affairs to elaborate two and three-stage missiles equipped with parachutes, cameras and radio transmitters. None has yet gone aloft with a dog aboard; but the next best thing—insects—will take a ride soon on the Mojave.

Rocketeers Are Teen-Agers

The designer-builders are, for the most part, teen-agers of colleges and high schools in the Los Angeles area. Most of them will admit what they learn about their hobby—rocket construction, fuses, fuel and firing techniques — isn't new, and that most of their findings are old hat at Cape Canaveral or White Sands.

But the fail-and-try-again persistence reaps big dividends when carried back to school classrooms and laboratories.

VanWagner says, "We could find out from books in a minute what may take us days to learn in the desert. But that's no real achievement. Besides, we may come up with something accidentally that can benefit rocketry in general."

The RRS has been experimenting, for example, with rocket mail; a field which, if properly exploited, could someday become as common as airmail.

The RRS site, about 22 miles northeast of the steaming desert town of Mojave and about 120 miles from Los Angeles, sprawls, along sagebrush-covered terrain from a range of hills on one side

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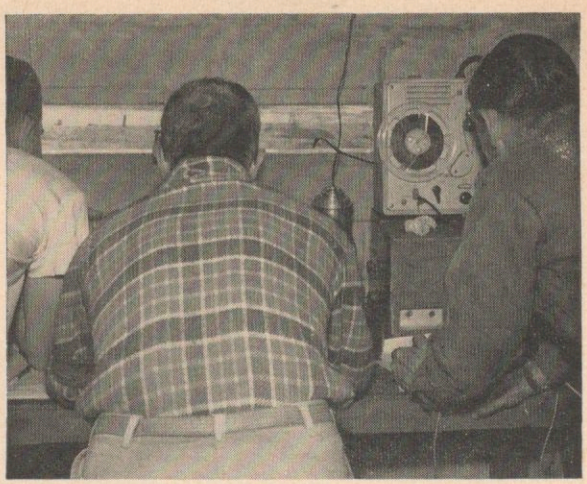
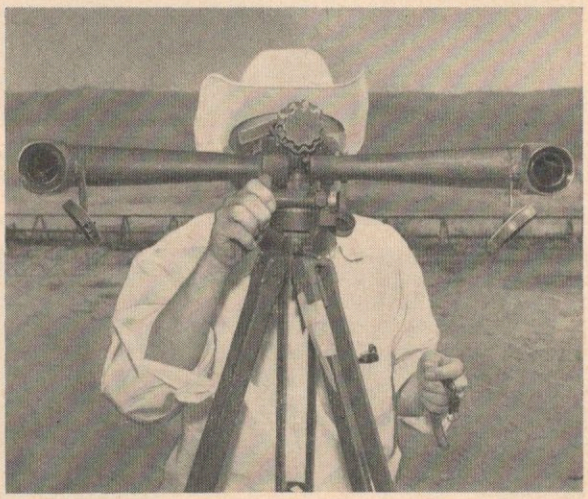
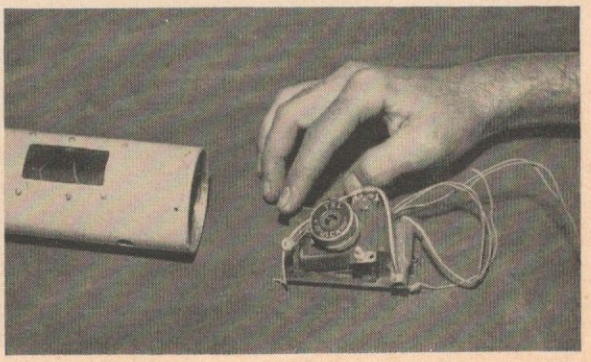


Inside the blockhouse, crewmen watch the rocket launching through slit windows. Rockets are triggered from this building. Recorder, used for research, picks up sounds of launching



Tracking-team member sights falling rocket and records bearing. Location of the buried rocket can be found by triangulation

Miniature camera is inserted in second stage of three-stage rocket. Burning fuel burns away string, clicking the shutter



These Rocketeers Play Safe

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to the lower desert floor on the other. A 10-foot launching stand and an even more elaborate static-test stand have been set up in the center of the site. The launcher, constructed of heavy-grade steel tubing, pivots on a concrete base and can be adjusted to varying angles. By changing the "pitch" of the launcher, and computing expected thrust of a rocket and its fuel, the landing area of a missile can be pinpointed to within a few feet.

But because a rocket upon launching can suddenly become a wild, uncontrollable weapon, due to wind drift, uneven fuel charge or for many other reasons, additional protective steps are taken.

Spectators are confined to slit trenches, fronted by earth mounds. Actual triggering is done by remote control from a concrete blockhouse 60 feet away. A system of green, yellow and red flags—visible anywhere in the firing area—signifies whether a rocket is fueled, armed or in storage.

Visitors Given Instruction

Visitors to the area are given detailed instruction sheets and must sign waivers of liability. A strict firing procedure goes into operation 15 minutes before a rocket is triggered, ending with a siren's wail and a 10-second countdown.

Only at the conclusion of a day's firing, when rockets have been retrieved and volatile materials locked up, are spectators permitted in the rocket compound area to inspect the amateur missiles, take pictures and ask questions.

The average RRS rocket is three to four feet long, constructed of steel or aluminum tubing 2½ to 3 inches in diameter and carrying either three or four fins. Most nose cones are machined steel, although some made of cork or other experimental materials have worked successfully.

The average rocket, powered with a properly tamped fuel, propels itself to an altitude of between 2000 and 5000 feet. Highest altitude an RRS missile has reached is approximately 20,000 feet and the record for amateurs, set a year ago by a group in Inglewood, Calif., is 22,500 feet.

Tamping Fuel Is a Skill

Though solid propellants are actually rapid-burning fuels, they appear to be explosive. Packed too loosely in a rocket shell, they fizzle. Tamped too tightly, they explode. Finding the right firmness between these extremes is a skill which RRS members strive for.

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Powdered fuel burns at the rate of one foot every tenth of a second in the rocket tube; the average rocket is spent in less than one second. It is the thrill of achieving this split-second of perfection, watching his rocket *whoosh* gracefully from the launching pad without wavering, toward which an amateur rocketeer of the RRS often works for weeks, even months.

Sometimes the work is in vain.

At a recent Mojave RRS launching, the most elaborate homemade missile of the day was a 16-foot, three-stage affair carrying a miniature camera and a parachute. Its builder spent more than two months in planning and building.

In less than 17 seconds, the rocket smashed into oblivion when the parachute failed to open and the rig crashed into the desert soil at more than 500 miles per hour.

Most of the RRS rockets are recoverable, and the total losses are rare. Tracking teams stationed in trenches around the impact area follow the airborne missile with special instruments which automatically record its compass bearing upon landing. The rocket can be located by triangulation.

Whether the RRS and its sister societies can maintain their excellent safety record depends, of course, on enforcement of its safety rules.

Some rocket experts, such as Capt. Robert C. Truax, of the Department of Defense's Advance Research Project Agency, think such precautions are adequate but recommend even safer rockets in the hands of amateurs. Truax, in fact, has designed a steam-propelled rocket which he says would be safer.

Equipped with a safety valve, Truax's missile is capable of hurling itself to altitudes of more than 10 miles—more than five times the present amateur record.

While the RRS hasn't yet tried steam, it's hard to predict what may be on the drawing boards of its young members. Meanwhile, it's a job of experiment and fail, try again and succeed.

Successes and Fizzles

On a typical RRS launching day, only about half of the 10 to 15 missiles launched can be rated as complete successes. Some smoke awkwardly on the launching pad. Others fizzle a few feet from the stand and occasionally one explodes in mid-air.

But if only one goes off perfectly all day—and it's a rare occasion when the record is that bad—the young scientists of the RRS are happy.

Parents and friends, watching from the protective cover of slit trenches and barricades a thousand feet away, get a kick out of it, too! ★ ★ ★