Technical Note TN-4

THE FINE ART OF PAYLOAD LAUNCHING

Whatever Goes Up…

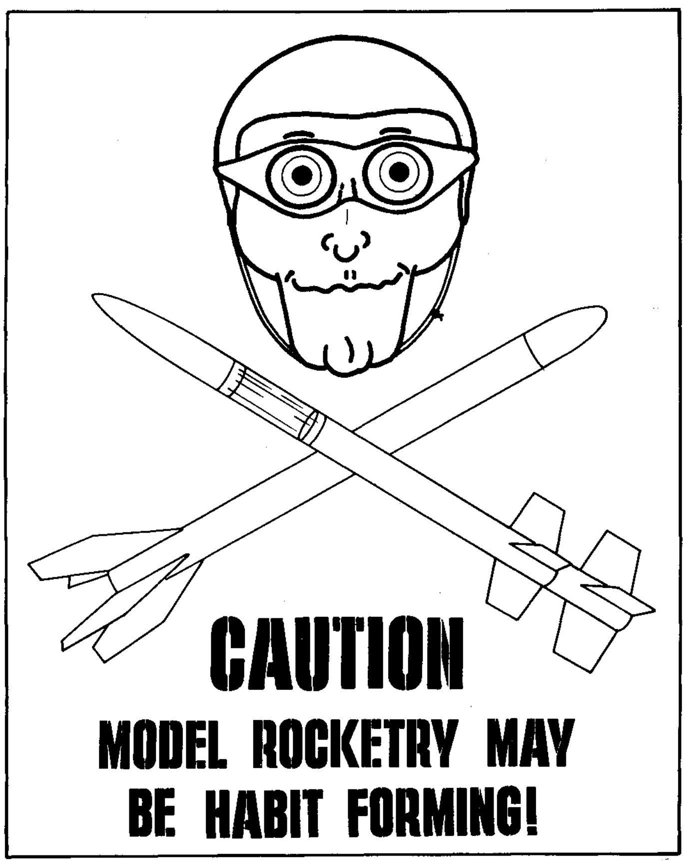
by Robert L. Cannon

Why do you launch model rockets?

Is it for fun? Sure it is! But is that all there is to it?

Probably not. If all you want to do is see your rocket go up and then come back safely so you can launch it again, you are in the minority among model rocketeers. Most modelers want to know why things happen and how to make them happen. Specifically, they want to make the best rockets they can.

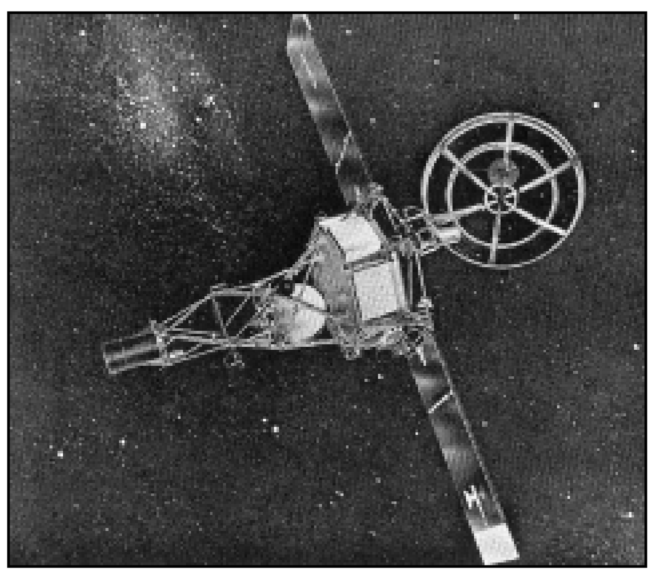
Once the model rocketry bug has taken a firm bite on you, you soon become involved in center of gravity-center of pressure relationships, fin area experiments, weight-optimizing problems and other previously abstract studies.



One of the first challenges you set for yourself is probably to get your rocket the highest with a given size of engine.

After you become proficient at reaching high altitudes, the parachute-duration fever may become "your" disease. After winning a few (meets) and losing a few (birds), you will probably want something else with which to test yourself. The payload passion may be your next mania.

Why is something put in a rocket before the rocket is launched? The professional may be sending up an instrument package to secure data on the atmosphere. The payload may be a scientific satellite to study Earth or to secure information on stars. Some payloads are spacecraft whose missions are to study other planets. Occasionally, a rocket carries men on a mission to the moon.



You realize right away that a model rocket is not designed for orbital missions. In fact, you don't want your rocket to get far enough away to even stand a strong chance of losing it!

The question keeps re-occurring - "What can I launch?" It need not be anything scientific. The payload plague has struck and you are now past all chance of avoiding it. Your only hope now is to control the course of the disease.

You notice your hand twitches uncontrollably. After nearly every twitch, it is holding some small object. Compulsively you heft the object to get an idea of its weight. Your eyes squint as they calculate the size of payload compartment the object will require. Your arm jerks as you estimate whether the g-forces of take-off will damage the object.

SPECIMEN	WEIGHT (Typical) in grams & oz.	LENGTH (Typical) in mm & inches	WIDTH (Typical) in mm & inches
Grade A large chicken's egg	64 grams 2.25 oz.	70 mm 2.8 in.	50 mm 2.0 in.
Grade A small chicken's egg	58 grams 2.04 oz.	57 mm 2.25 in.	40 mm 1.5 in.
Grasshopper	2 grams 0.07 oz.	37 mm 1.5 in.	10 mm 0.4 in.
Fly	0.25 grams 0.01 oz.	10 mm 0.4 in.	5 mm 0.2 in.
Spider	0.25 grams 0.01 oz.	10 mm 0.4 in.	3 mm 0.1 in.
Earthworm	4 grams 0.14 oz.	64 mm 2.5 in.	3 mm 0.1 in.
Beetle	0.5 grams 0.02 oz.	25 mm 1.0 in.	5 mm 0.2 in.
Cricket	0.3 grams 0.01 oz.	25 mm 1.0 in.	7 mm 0.3 in.
Guppy	0.5 grams 0.02 oz.	37 mm 1.5 in.	10 mm 0.4 in.

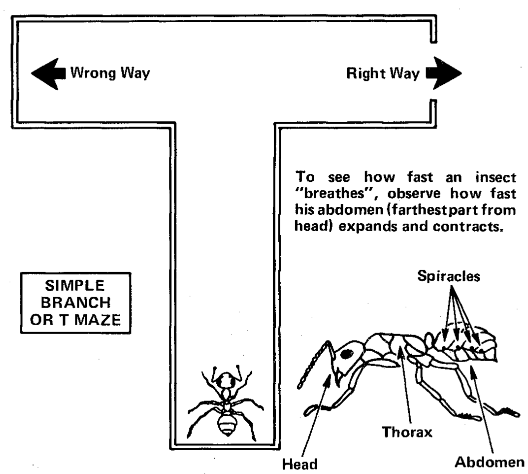
Pretty soon a compulsion strikes. The object in your hand has got to go! Maybe you will launch it tomorrow, maybe it can't wait. The blue sky beckons, and the rocket awaits!

Soon you have several "space launches" behind you. Most of them were pretty good, I hope. Did you lose any payloads because the nose cone wasn't tight enough on the payload compartment? Did any payloads, complete with rocket, make an unexpected swift re-entry with a very compact parachute (rolled too tightly, stuck in the body tube or just plain melted)? Did a "Rocketus eatumupus" manage to snag one as it drifted past?

At this point you probably begin to lose interest in launching payloads. Don't! Payload launching can be very worthwhile and can be a lot of fun for a long period of time. After your first few launches of rocks, payload weights and handy insects, you can really get down to serious payloading.

For performance tests of your "bird", launches of official payload weights are hard to beat. (Official one ounce payload weight, PL-1). Careful selection of the best engine for the mission, proper construction of that special payloader and precise packaging of the payload weights are all important parts of the game before you push that button to launch your bird for the official tracked flight.

If you feel the desire to launch a small biological payload, do so with care. Wasps and bees make compact passengers for all but the very smallest payload compartments. However . . .

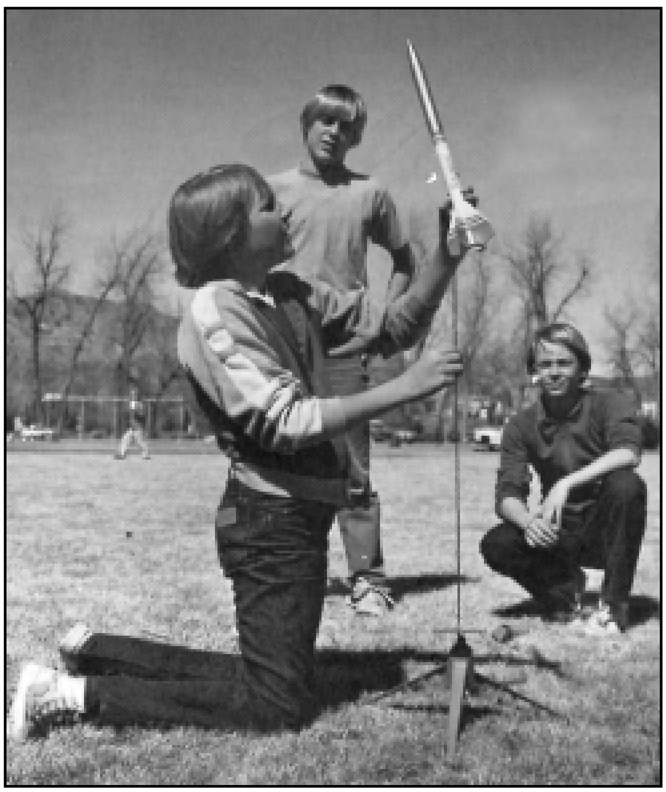


Cat. No.	Body Mat'l.	Fits	Inside Dia.	Inside Length	Overall Length	Wt. in oz. Net	Ship
PS-20A	Clear Plastic	BT 20	.710"	2"	4.00"	.16	1
PS-20C	Clear Plastic	BT 20	.950"	3"	7.00"	.40	4
PS-30B	Regular Tube	BT 30	.725"	2"	3.75"	.24	1
PS-50A	Clear Plastic	BT 50	.950"	3"	6.50"	.39	4
PS-50C	Clear Plastic	BT 50	1.59"	4"	10.50"	1.00	11
PS-50E	Clear Plastic	BT 50	1.75"	4"	10.50"	1.10	11
PS-55B	Regular Tube	BT 55	1.28"	3"	7.63"	.53	11
PS-60A	Clear Plastic	BT 60	1.59"	4"	9.50"	.98	11
PS-60C	Clear Plastic	BT 60	1.75"	4"	9.50"	1.00	11

Payload sections include nose cone, body tube, adapter or bulk head.

Crickets, grasshoppers and flies may be launched. Even if you goof, these creatures stand an excellent chance of surviving an error on your part. But don't launch them and recover them and expect to learn much by just looking at them. Some rocketeers "train" their passengers to do a simple one-branch maze or something similar, then test their reactions after flight. The results won't mean much if the specimen was damaged by poor handling or packaging in the payload compartment. Another problem can be that the effects you attribute to the g-forces experienced on the flight may be caused instead by a shortage of air in a too-small payload capsule.

Insect launches are not likely to lead to the discovery of much valuable data, but they can be one step in becoming proficient in handling payloads. A well-designed experiment can provide meaningful research data on the effect of rocket flight on an insect.



When you feel that you are good at handling biological payloads, I mean really good, then don't launch a hamster or a mouse! It appears that about nine out of ten launches of live hamsters or mice end successfully. About every tenth launch, however, the passenger suffers serious injury or death due to a human error. It is about as kind to stomp the poor mouse to death as it is to let him die because of your mistake, and he probably won't be scared half-to-death for anywhere near as long. Also, it is against the Model Rocket Safety Code to launch anything other than insects.

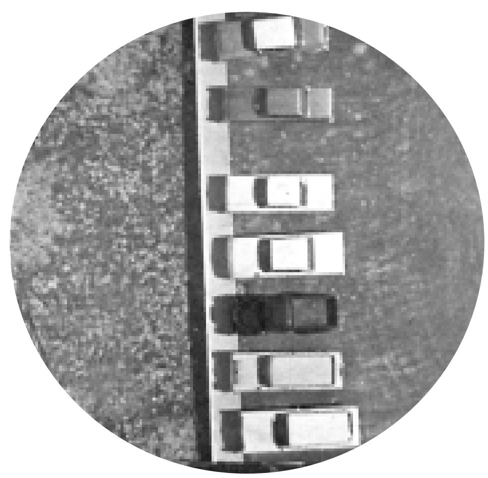
To really test your biological payload handling capabilities, launch a chicken's egg. Use a raw one. (Hard-boiling is not fair.) If you can properly handle, package, launch and recover the egg in good condition, excellent! If not, you can always have scrambled eggs for breakfast. This, unfortunately, leaves the payload compartment of your rocket in a "yucky" condition. Place the egg in a ziplock bag to avoid this mess.

Launching and safely recovering a raw chicken's egg is not as easy as it sounds. If you think it is easy, just try it.

When you are ready to get into instrument payloads, you have a wide-open field.

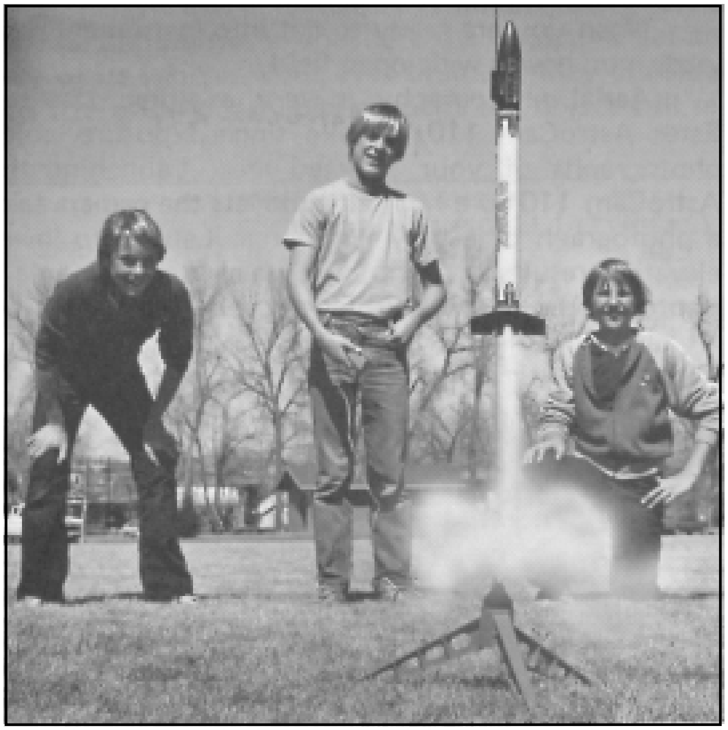
Aerial photography is very exciting. Use the Estes AstroCam® 110 or AstroCam® RTF to take single exposure, color photographs of your selected area. Launching the AstroCam® to a high altitude lets the camera take a photograph of a very large area. Launch to lower elevation results in a photo in which a smaller area is photographed, but everything appears bigger.

HIGH ELEVATION SHOT



LOW ELEVATION SHOT

To make a photographic map of a very large area, a mosaic (composite made up of many small parts) is made of a number of different aerial photographs, each of which has been photographically enlarged or reduced so that the photos appear to have been taken from the same elevation. A project of this nature can be challenging, very rewarding and a lot of fun. An aerial map makes a great science project.



Instruments other than cameras may be launched. These instruments can be self-recording or may radio their data back to the ground by telemetry.

Working within the size and weight limitations of model rocketry and producing accurate scientific instruments is quite a challenge. A number of different instrument systems are possible. They need not be complex, but should be simple and able to withstand the forces encountered in model rocket flight.