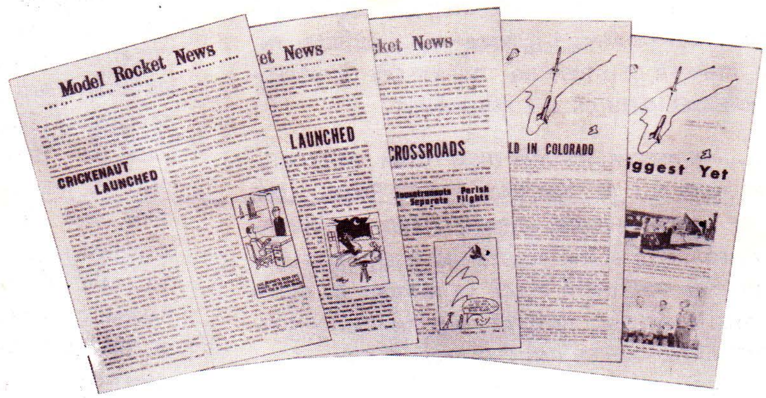
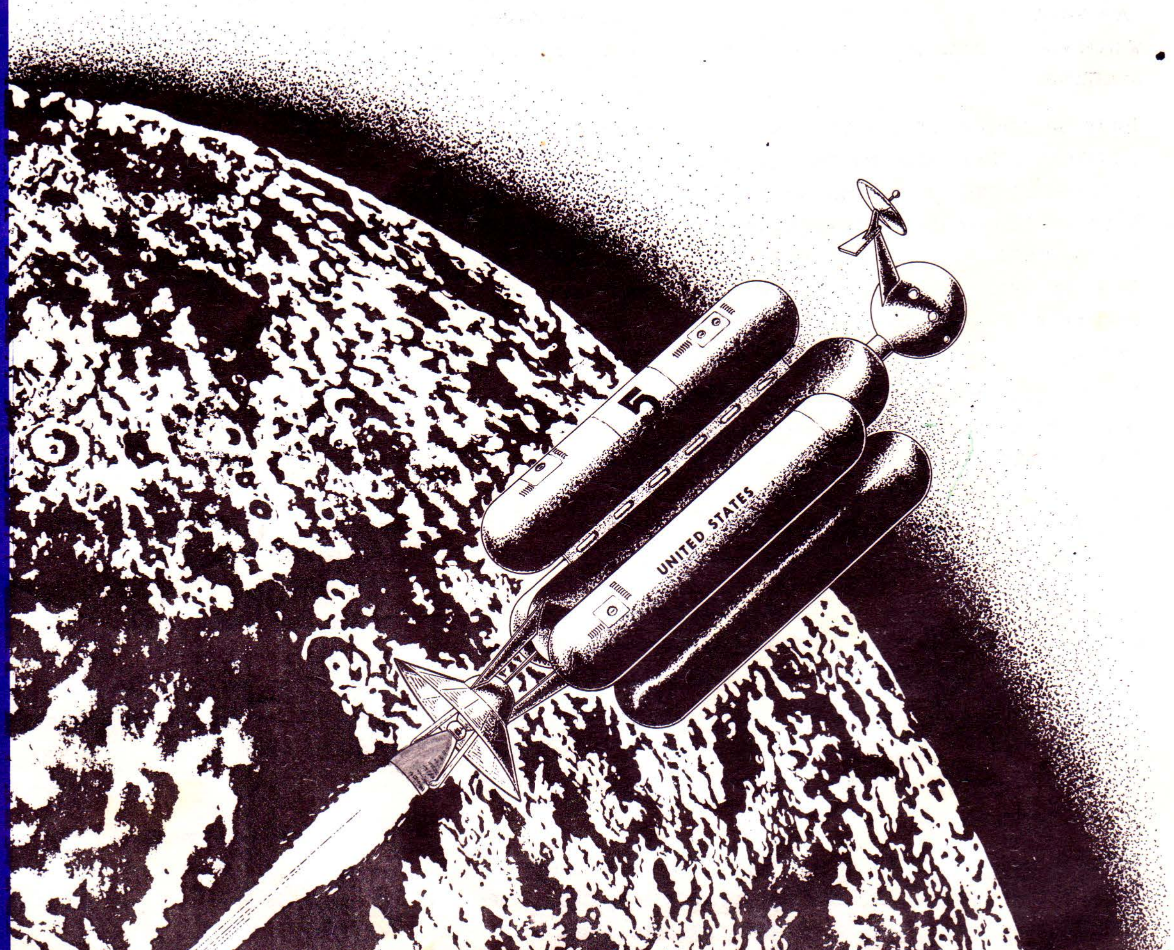
MODEL ROCKET NEWS

The Best from Volumes 1 and 2





Estes Industries, Inc.

BOX 227
PENROSE, COLORADO

Devoted to . . . Safety . . . Education . . . Enjoyment . . . in rocketry

(From Volume 1, Number 2)

CRICKENAUT LAUNCHED

A YOUNG SCIENTIST, 14 YEAR OLD BILL WALDRON (NAR #1014) OF 2343 RALEIGH ST., DENVER, COLORADO WILL GO DOWN IN HISTORY AS THE PIONEER OF STUDYING THE EFFECT OF ACCELERATION AND ROCKET FLIGHTS ON THE CRICKENAUT.

RECENTLY, BILL, A MEMBER OF THE MILE HIGH SECTION, BROUGHT TWO CRICKETS OUT TO HOG BACK ROCKET RANGE, ONE BY THE NAME OF LEIKA AND THE OTHER CALLED NO-LEIKA. THESE TWO UNTAMED WILD BLACK BEASTS HAD BEEN CAREFULLY PREPARED AND TRAINED FOR THEIR PLACE IN HISTORY BY BEING REMOVED FROM THEIR NATURAL HABITAT AND CAREFULLY CONCEALED IN A VENTILATED COFFEE CAN FOR FOUR HOURS.

UPON ARRIVING AT THE RANGE, BILL AND HIS MEDICAL AND LAUNCHING CREW METHODICALLY WENT TO WORK IN A MANNER WHICH WOULD MAKE THE BOYS DOWN AT THE CAPE LOOK LIKE AMATEURS.

THEIR SPECIALLY CONSTRUCTED ROCKET WAS BROUGHT OUT AND CAREFULLY POSITIONED ON THE LAUNCHING PAD. THE COUNT-DOWN WAS STARTED AT X MINUS 15 MINUTES. AT APPROXIMATELY X MINUS 12 MINUTES, FINAL CONNECTIONS TO THE ROCKET FIRING PANEL HAD BEEN COMPLETED AND IT WAS ANNOUNCED THAT THE SPACE VEHICLE WAS READY FOR LAUNCHING. ALL THAT REMAINED WAS THE FINAL CHECK-OUT OF THE TWO CRICKENAUTS.

THE MEDICAL CREW WENT TO WORK. WHILE NO HEART BEAT OR RESPIRATION WAS DETECTED, THE CRICKETS WERE ASSUMED TO BE ALIVE AND HEALTHY BECAUSE THEY WERE MOVING ABOUT AND CHIRPING. THE FINAL DECISION OF THE MEDICAL MEN WAS THAT THE TWO CRICKETS WERE IN PERFECT HEALTH AND READY TO ENTER THE CAPSULE IN THE NOSE OF THE ROCKET.

AT APPROXIMATELY X MINUS 3 MINUTES THE CRICKETS WERE CAREFULLY BROUGHT OUT TO THE LAUNCHING PAD AND SHOVED INTO THEIR SCIENTIFICALLY DESIGNED COMPARTMENTS.

NO-LEIKA WAS POSITIONED IN THE UPPER COMPARTMENT, WHICH WAS NOT PADDED. LEIKA WAS PLACED IN A MORE COMFORTABLE PADDED COMPARTMENT COMPLETE WITH WINDOWS FOR HIS VIEWING OF THE EARTH BELOW.

COMPLETE DETAILS OF THE ROCKET SHIP USED IN THIS EXPERIMENT, ITS WEIGHT, SIZE, PAYLOAD COMPARTMENT, ETC., ARE STILL CLASSIFIED. HOWEVER, WE WERE ABLE TO LEARN THAT A 16# ENGINE WAS BEING USED. CONSIDERING THE PROBABLE WEIGHT OF THE ROCKET, THIS WOULD SUBJECT THE TWO CRICKENAUTS TO AROUND 50 TO 100 G'S ACCELERATION. WOULD THEY SURVIVE THIS TREMENDOUS FORCE?

TIME IS RUNNING, X MINUS 60 SECONDS CAME OVER THE COMMUNICATIONS NETWORK.

"TRACKING EAST IS READY"---"TRACKING WEST IS READY." FINAL SAFETY CLEARANCE IS GIVEN FOR THE LAUNCHING. TIME IS X MINUS 5 SECONDS, 4---3---2---1---ZERO.

A LOUD CHEER IS HEARD FROM THE MEMBERS OF THE CREW AND SPECTATORS AS THE ROCKET ZOOMS SKYWARD UNDER THE TREMENDOUS ACCELERATION.

AS THE ROCKET REACHED THE APEX OF ITS FLIGHT, THE PARACHUTE WAS AUTOMATICALLY DEPLOYED. (DUE IN PART TO LACK OF TRAINING AND IN PART TO THE DOUBTFUL APTITUDE AND ABILITY OF THE CRICKENAUTS, IT WAS DECIDED TO LEAVE NO IMPORTANT PHASE OF THE OPERATION TO THEIR MANUAL CONTROL.) THEN BEGAN THE LONG AND TEDIOUS JOB OF TRACKING THE ROCKET ON ITS DESCENT TO EARTH. (APPROXIMATELY 30 SECONDS.) DID THE CRICKETS SURVIVE? WOULD THE PADDING HELP LEIKA? WOULD NO-LEIKA SURVIVE WITHOUT PADDING? IT HAD BEEN AGREED IN ADVANCE THAT ONLY THE MEDICAL TEAM WOULD BE PERMITTED TO EXAMINE AND INTERVIEW THE SPACE HEROES.

THE CAPSULE WAS DOWN AND THE MEDICAL TEAM RUSHED TO RETREIVE IT. NO-LEIKA WAS UNCONSCIOUS. OXYGEN WAS NEEDED. EVERYTHING HAD BEEN CONSIDERED BEFORE LAUNCHING. NO DETAIL HAD BEEN OVERLOOKED. OXYGEN WAS SUPPLIED IN NO TIME BY FANNING THE CRICKET WITH A PIECE OF CARDBOARD. BUT STILL NO-LEIKA LAY ON HIS (MAYBE HER) BACK UNCONSCIOUS. MAYBE HE WAS DEAD. AS BEFORE THE LAUNCH, NO HEART BEAT OR RESPIRATION COULD BE DETECTED BY THE MEDICAL CREW. THE QUICK THINKING MEDICAL MEN CALLED FOR COLD WATER TO HELP REVIVE NO-LEIKA. HAVING NO WATER READILY AVAILABLE, A QUICK DECISION WAS REACHED TO DOUSE NO-LEIKA WITH PEPSI-COLA. IT WORKED!! A CHEER AROSE FROM THE SPECTATORS AS NO-LEIKA SPRANG TO LIFE. WHAT COULD HAVE BEEN A COMPLETE FAILURE WAS NOW PROCLAIMED A SUCCESS.

LEIKA WAS FOUND ALIVE, CHIRPING, AND IN THE BEST OF HEALTH. APPARENTLY, SHE (OR HE) HAD SUFFERED NO BAD EFFECTS OF ANY SORT. PERHAPS IT WAS BECAUSE OF THE PADDING. MAYBE THE WINDOWS HELPED. MAYBE LEIKA WAS SIMPLY A BETTER CRICKENAUT.

FINAL SUMMATION

IN SUMMARIZING THE RESULTS OF THE ABOVE TEST, WE BELIEVE IT WOULD BE SAFE TO SAY THAT NO-LEIKA NO LIKED HER ROCKET TRIP AND LEIKA LIKED HER ROCKET TRIP. BUT IF LEIKA HAD BEEN NO-LEIKA AND IF NO-LEIKA HAD BEEN LEIKA THEN LEIKA WOULD HAVE NO LIKED AND NO-LEIKA WOULD HAVE---------OH WELL,-----------------FORGET IT.

THE ABOVE EXPERIMENT IS TRUE. ONLY THE NAMES OF THE CRICKENAUTS HAVE BEEN CHANGED TO PROTECT THE INNOCENT. ALSO, A FEW MINUTE DETAILS MAY HAVE BEEN ALTERED OR INVENTED TO SUIT THE FANCY OF THE AUTHOR.

The type of activity referred to in this article as amateur rocketry would be more correctly known as "basement bombing". While the basement bomber will loudly proclaim that he is an amateur, his activities are vastly different from those of the true amateur who works under the close professional supervision of an expert adult, with extensive safety precautions and who has a broad technical knowledge of the chemistry and physics involved--and uses it for his own safety as well as for those around him.

MODEL ROCKETRY versus AMATEUR ROCKETRY
SAFETY SURVEY REPORT

THERE IS A VAST DIFFERENCE IN THE RELATIVE SAFETY OF MODEL ROCKETRY AND AMATEUR ROCKETRY. MANY ADULTS, OFFICIALS, YOUNG ROCKETEERS AND POTENTIAL ROCKETEERS DO NOT REALIZE THIS DIFFERENCE. IN FACT, MANY DO NOT EVEN REALIZE THE DISTINCTION BETWEEN THE TWO FORMS OF ROCKETRY. IT IS THE PURPOSE OF THIS REPORT TO POINT OUT THE DIFFERENCES FROM THE SAFETY STANDPOINT ONLY. FOR OUR REFERENCE WE SHALL DEFINE THESE TWO NON-PROFESSIONAL FORMS OF ROCKETRY AS FOLLOWS:

MODEL ROCKETRY: THE ART, SPORT, OR HOBBY OF STUDYING, DESIGNING, CONSTRUCTING, AND FLYING LIGHT WEIGHT, NON-METALLIC, RECOVERABLE, AND RE-FLYABLE ROCKETS USING COMMERCIALLY PRODUCED ROCKET ENGINES, WHICH DO NOT REQUIRE THE HANDLING, LOADING, OR COMPOUNDING OF THE PROPELLANT OR OTHER EXPLOSIVE MATERIALS BY THE USER.

AMATEUR ROCKETRY: THE ART OF STUDYING, BUILDING, EXPERIMENTING WITH AND LAUNCHING ROCKETS OF VARIOUS DESCRIPTIONS (HEAVY AND LIGHT), OFTEN USING METALLIC COMPONENTS, WHERE THE USER OR EXPERIMENTER IS USUALLY REQUIRED TO HANDLE, FORMULATE OR LOAD HIS OWN PROPELLANT OR OTHER EXPLOSIVE COMPOUND.

IN FEBRUARY, 1961, ESTES INDUSTRIES, INC., SENT OUT 1000 QUESTIONNAIRES TO A GROUP OF MODEL ROCKET ENTHUSIASTS SELECTED AT RANDOM FROM THEIR CUSTOMER LIST. INCLUDED IN THIS QUESTIONNAIRE WERE TWO QUESTIONS DESIGNED PRIMARILY TO ESTABLISH THE RELATIVE SAFETY OF MODEL ROCKETRY AND AMATEUR ROCKETRY. THE FOLLOWING RESULTS WERE RECEIVED AND RECORDED.

NUMBER OF QUESTIONNAIRES SENT OUT	1,000
NUMBER OF QUESTIONNAIRES RETURNED	340
PERCENTAGE OF QUESTIONNAIRES RETURNED	34%

ACCIDENTS IN MODEL ROCKETRY

FROM THE 340 REPORTING, THE FOLLOWING RESULTS WERE OBTAINED.
TO THE QUESTION------DO YOU KNOW OF OR HAVE YOU HEARD OF ANY ACCIDENTS USING OUR PRODUCTS? (MODEL ROCKET PRODUCTS)

DID NOT ANSWER	14	4%
NO (ANSWERS)	326	96%
YES (ANSWERS)	0	0%

ACCIDENTS IN AMATEUR ROCKETRY

FROM THE 340 REPORTING, THE FOLLOWING RESULTS WERE OBTAINED.
TO THE QUESTION------DO YOU KNOW OF OR HAVE YOU HEARD OF ANY ACCIDENTS USING HOME MADE PROPELLANTS?

DID NOT ANSWER	18	6%
NO (ANSWERS)	124	36%
YES (ANSWERS)	198	58%

NATURE OF YES ANSWERS; 148 OF THE AFFIRMATIVE ANSWERS TO THIS LAST QUESTION WERE SIMPLY YES, CARRIED LITTLE DETAIL, OR WERE STRICTLY SECOND HAND NEWSPAPER REPORTS. 50 OF THE 198 YES ANSWERS TO ACCIDENTS INVOLVING AMATEUR ROCKETRY APPEAR TO BE FIRST-HAND ACCOUNTS AND GIVE SOME INFORMATIVE DETAILS OF THESE ACCIDENTS. THESE ARE RECORDED AS FOLLOWS:

"YES, HAPPENED TO SOME OF OUR CLUB MEMBERS."

"A FUEL CHARGE OF KNO_3 PLUS $C_{12}H_{22}O_{11}$ FLASHED IN A BOY'S HOUSE."

"A FRIEND LOST A FINGER AND SUFFERED FACIAL DEFORMATIONS."

"A TWELVE YEAR OLD BOY LOST SIGHT OF ONE EYE EXPERIMENTING WITH HOME MADE PROPELLANTS."

"A NEAR ACCIDENT OCCURRED WHEN ONE BOY MIXED HIS OWN FUELS---THE ROCKET WENT WILD."

"YES, A BOY ALMOST BURNED HIS THUMB OFF."

"YES, FOR ONE, A BOY TRIED IT AND GOT KILLED."

"YES, BUT IT HAPPENED WHERE LITTLE KNOWLEDGE OF BASIC SAFETY RULES WERE USED."

"HOME MADE ROCKET EXPLODED IN BOY'S FACE, NEARLY BLINDING HIM."

"YES, A BOY HAD HIS HAND BLOWN OFF."

"FELLOW IN AREA USED METAL FINS AND LOST AN EYE AND DEFORMED AN EAR."

"YES, A FRIEND OF MINE FAILED TO FOLLOW MY DIRECTIONS AND SUFFERED A SLIGHT SKULL INJURY."

"SEVERAL YEARS AGO A BOY IN MY CLASS BURNED HIS HAND WHILE WORKING WITH ZINC-SULPHUR."

"YES, BUT I WAS A FOOL OF TWELVE AND I DON'T RECOMMEND IT AT ALL. I ALMOST BLEW MY EYE OUT."

"THERE WAS AN EXPLOSION IN AN AREA SCHOOL LAST WEEK. A CHEMISTRY CLASS WAS ATTEMPTING TO MAKE A LIQUID-FUEL ROCKET."

"YES, NUMEROUS, THAT'S WHY WE ARE STICKING WITH N.A.R."

"I WAS MAKING SOME HOME MADE ROCKET FUEL, PUT IT IN A BOTTLE, LIT IT AND IT EXPLODED AND I GOT BURNED BADLY."

"YES, A BOY TRIED MATCH HEADS AS FUEL AND LOST HIS HAND."

"SOME BOYS USED MATCHES FOR FUEL AND IT BLEW UP, INJURING THEM."

"A BOY (MY FRIEND) MADE ONE OUT OF BLACK POWDER (HOME MADE) AND HE LOST PART OF HIS FINGER WHEN IT EXPLODED."

(CONTINUED ON PAGE 4)

"I GOT WOUNDS CLEAR TO THE BONE WHEN A MOTOR BLEW UP WHILE I WAS MAKING IT. I JUST FINISHED RECOVERING."

"ONLY FROM HOMEMADE ROCKET ENGINES USING EXPLOSIVES FOR FUEL AND METAL CONTAINERS FOR ROCKETS."

"MY COUSIN'S HOMEMADE ROCKET BLEW UP THE CORN CRIB."

"YES, STUDENT LOST A FINGER."

"ONE OF MY FRIENDS HAD A ROCKET BLOW UP ON THE LAUNCHING PAD."

"YES, OUR NEIGHBOR GOT BURNED ON GUNPOWDER AND SULPHUR."

"YES, A BOY FROM TEXAS HAD THREE FINGERS BLOWN OFF AND ANOTHER HAD AN EYE PUT OUT."

"YES, THERE HAVE BEEN MANY INCLUDING ONE FELLOW USING RED PHOSPHORUS AND $KClO_4$."

"I HEAR ABOUT THEM FREQUENTLY. THAT IS WHY I SWITCHED TO COMMERCIALLY MADE MOTORS."

"YES--MYSELF. LACERATIONS OF LEFT HAND IN PREMATURE DETONATION OF ROCKET."

"A BOY LOST TWO FINGERS IN OUR AREA ABOUT TWO YEARS AGO."

"ONCE A BOY GOT THE SIDE OF HIS FACE BLOWN OFF WHEN HIS HOMEMADE ROCKET BLEW UP."

"A BOY IN OUR SCHOOL WAS BLINDED FROM AN EXPLOSION."

"THROUGH HIS OWN CARELESSNESS, A BOY I KNOW MUTILATED HIS RIGHT THUMB AS THE RESULT OF AN EXPLOSION."

"YES, A BOY LOST HIS FINGERS AND ONE EYE ABOUT A MONTH OR TWO AGO IN CHICAGO."

"A BOY WAS SEVERELY INJURED USING MATCH HEADS AS A PROPELLANT."

"YES, MYSELF. I BURNED MY HAND BADLY LAST MAY 14 ON HOMEMADE PROPELLANT."

"A BOY WAS INJURED TAMPING AN IGNITER INTO A ROCKET."

"YES, BY USING COMPRESSED AIR TO FORCE THE FUEL DOWN TO THE ENGINE."

"AT OWESCO HIGH SCHOOL SOME KIDS WERE USING GUNPOWDER FOR ROCKET FUEL, IT WENT OFF, 10 WERE INJURED."

"YES, THE EXPLODING OF A ROCKET USING GUNPOWDER AS A PROPELLANT."

"A FRIEND OF MINE KNEW A BOY WHO LOST A HAND FOOLING AROUND WITH CO_2 MATCH HEAD ROCKETS."

"A FRIEND OF MINE WAS USING ZINC AND SULPHUR--SLIGHTLY BURNED."

"YES, BUT FEEL IT WAS DUE TO IGNORANCE AND CARELESSNESS."

"A ROCKET BLEW UP NEAR HERE AND HURT A BUILDING."

"I KNOW A BOY WHO STUFFED AN EMPTY RIFLE SHELL WITH MATCH HEADS; IT EXPLODED AND HE NEARLY LOST A HAND,"

"YES, A BOY RECENTLY BLEW HIS HAND OFF WHEN HIS ROCKET EXPLODED."

"YES, I HAVE HAD MANY WHEN I BUILT THEM, BUT NOW I ONLY USE COMMERCIAL MOTORS."

"YES INDEED. MANY KIDS AROUND HAVE MADE PROPELLANTS, WHICH HAVE BLOWN UP, AND HURT THEMSELVES."

"YES, ONE FRIEND OF MINE CUT HIS HAND SERIOUSLY WHEN HE TRIED IT."

SUMMARY

SUMMARY: THIS SURVEY IS THE LARGEST OF ITS KIND EVER CONDUCTED, AND THE COMPILATION OF THE REPORTS, MANY OF A FIRST-HAND NATURE, INDICATE THAT BEYOND A SHADOW OF A DOUBT THERE IS AN ENORMOUS DIFFERENCE BETWEEN THE SAFETY OF MODEL ROCKETRY AND THAT OF AMATEUR ROCKETRY. THE REPORTED FACTS TEND TO SUBSTANTIATE THE FACT THAT CAREFUL MODEL ROCKETEERS WHO FOLLOW THE RULES OF THE NATIONAL ASSOCIATION OF ROCKETRY ACTUALLY FACE LESS DANGER THAN IN MANY OTHER SPORTS AND HOBBIES SUCH AS BASEBALL, SWIMMING, SKIING, BOATING, MODEL AIRPLANES, AND GO-KARTING. THE SURVEY REPORTS ALSO INDICATE THAT THE AMATEUR ROCKETEER FACES HAZARDS WHICH, BECAUSE OF LACK OF KNOWLEDGE, TRAINING, OR EXPERIENCE, DO NOT MAKE THEMSELVES APPARENT TO HIM UNTIL IT IS TOO LATE. AMATEUR ROCKETEERS, ACCORDING TO THE SURVEY, NORMALLY DO NOT HONESTLY REALIZE THE TERRIBLE DANGERS INVOLVED IN THEIR WORK, AND THEY WILL OFTEN ATTEMPT TO DO THINGS WHICH MAKE A PROFESSIONAL ROCKET ENGINEER SCREAM AND RUN FOR COVER. THE SURVEY RESULTS ALSO CONFIRM OTHER STUDIES WHICH HAVE SHOWN THAT THE DANGER IN NON-PROFESSIONAL ROCKETRY LIES IN THE HOME PREPARATION OF ROCKET PROPELLANTS AND THE MANUFACTURE OF ROCKET ENGINES.

WHAT CAN BE DONE TO PREVENT THESE ACCIDENTS? EACH OF YOU CAN HELP BY:

1. STOP BUILDING YOUR OWN PROPELLANTS BEFORE IT IS TOO LATE.
2. ENCOURAGE YOUR FRIENDS TO CONFINE THEIR ROCKET ACTIVITIES TO THE SAFE N.A.R. FORM OF MODEL ROCKETRY.
3. FOLLOW THE N.A.R. SAFETY CODE AS INCLUDED WITH THIS REPORT.
4. ENCOURAGE AND SUPPORT LEGISLATION WHICH WILL KEEP THE FIELD OF <u>MODEL</u> ROCKETRY OPEN AND UNRESTRICTED.
5. IF NEED BE (IF ACCIDENTS CONTINUE) ENCOURAGE AND SUPPORT LEGISLATION WHICH WILL IMPOSE SEVERE RESTRICTIONS ON THE BUILDING AND FIRING OF <u>AMATEUR</u> ROCKETS.
6. EVERY TIME SOMEONE REFERS TO YOUR ROCKET ACTIVITIES AS "AMATEUR ROCKETRY", SET HIM STRAIGHT. TAKE THE TIME TO EXPLAIN TO HIM THE DIFFERENCE BETWEEN <u>MODEL ROCKETRY</u> AND <u>AMATEUR ROCKETRY</u>. LET HIM KNOW THAT THERE IS A SAFE FORM OF ROCKETRY AND THIS IS THE TYPE OF ROCKET ACTIVITY IN WHICH YOU ARE ENGAGED.

THE SCIENTIFIC MINDED YOUTH OF AMERICA NEED A ROCKETRY PROGRAM------TO THIS WE WILL ALL AGREE. BUT, REMEMBER, OUR COUNTRY NEEDS <u>LIVE</u> SCIENTISTS AND ENGINEERS WHO HAVE BOTH HANDS, TEN FINGERS AND TWO EYES. ONLY A <u>SAFE</u> AND <u>SANE</u> PROGRAM OF ROCKETRY CAN HELP IN PRODUCING THESE SPACE MEN OF TOMORROW.

IT IS INTERESTING TO NOTE THAT MODEL ROCKETRY IS APPROVED AS A HOBBY FOR UNITED STATES AIR FORCE PERSONNEL, WHEREAS AMATEUR ROCKETRY IS NOT APPROVED BY THE USAF AND IS CONSIDERED UNSAFE.

Letter Section

The following are letters and excerpts from letters received from you rocketeers. Keep sending them in and we will try to print the ones which seem to have the most general interest.

We have received many letters and newspaper clippings telling of the launching of various live payloads including lady bugs, crickets, black beetles, ants, grasshoppers, mice, etc.

We are sorry that we do not have space to print all of them. The following letter is a typical example, telling of the launching of a "Toadenaut".

(From Volume 1, Number 3)

Dear Sirs:

James Dascola and I read your article published in the July edition of Model Rocket News, "Crickenauts Launched". We found it amusing and inspiring. That day we decided to try something along that line, so we ordered the parts for the "Bug a Bye" rocket.

We thought that launching an insect, as Bill Waldon did, would not suit our purpose. We wanted something that breathed and had a heart. We thought over various possibilities and decided on a toad. Next, we went to Mud Lake and captured about ten of them.

When our rocket arrived, we assembled the parts. The next day we selected one of our toadenauts and placed him (her) in an airconditioned jar (a few holes in the lid) and took off for the launching site. When all was ready, we placed the toadenaut in the padded capsule, slid the rocket down the launch rail and launched the rocket.

Everything went perfect. When the parachute opened we raced in the direction it was falling. When we got there we pulled off the nose cone and put him (her) in the jar. He looked a little dazed but in a few seconds he was all right. After a few days we gave it its freedom.

We could not have done it if it was not for the help of Estes Industries.

Sincerely,
Bob Neitzke

(From Volume 1, Number 3)

Dear Sir:

Will you please tell me, if I have adult supervision, would it be alright to construct a liquid bi-propellant rocket?

I am twelve years old but I know everything about rockets.

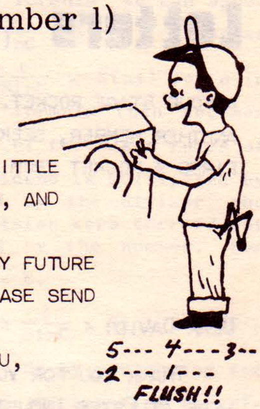
Sincerely yours,
John Enhoffer.

Dear John:

No twelve year old should build a liquid propelled rocket. He might not live to the ripe old age of 13.

Sincerely,
Vernon Estes

(From Volume 2, Number 1)



Dear Mr. Estes:

About a week ago, I was about to send you an order and I left my catalog out on my desk. Well, my little brother got ahold of it, tore it up, and flushed it.

I won't be able to send out any future orders without it, so would you please send me another.

Thank you,
R.J.,
West Lynn, Mass.

Dear R.J.:

Here's a new one. Better tie a string on it!

Sincerely,
Vernon Estes

(From Volume 2, Number 1)

Dear Gentlemen:

Today I launched the new Astron Space Plane. It was like any other except it carried a live mouse as a payload.

I ignited the rocket and ZOOM up into the wild blue yonder it flew. At the apex of its flight, the engine blew out and it started its long lazy flight to earth.

Graceful as a bird it swooped down and landed. We all ran toward it to see if the mouse was alive. It was! What a success.

Sincerely,
Bren Schulten
Darien, Connecticut

P.S. A true story.

Dear Bren:

Congratulations! To the best of our knowledge, you are the first to have successfully launched a live payload under rocket power and had it return by the glide re-entry method. You beat the Dyna-Soar Project to the punch.

Sincerely,
Vernon Estes

(From Volume 2, Number 1)

Dear M. Estes:

We have accomplished much since the formation of our club. We started off with a few of your excellent Astron Scout kits. Soon we were making high altitude single-stage rockets of our own design. From these we progressed to two-stage rockets of which we have launched over twenty. With test firings almost daily, we soon became almost experts in multi-stage design. We then built and launched a few three-stage rockets successfully. One of our very active members launched

(Continued on page 6)

Letters

(CONTINUED FROM PAGE 5)

A FOUR STAGE ROCKET. IT WENT OVER A MILE HIGH, WHILE ANOTHER MEMBER, SEEKING A NEW CHALLENGE, SUCCESSFULLY FIRED A ROCKET FROM UNDER WATER THIS VERY DAY.

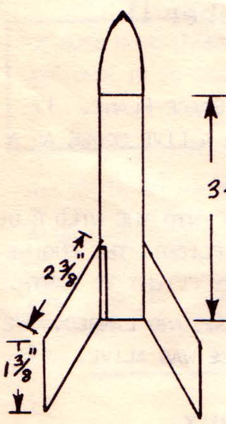
VERY SINCERELY YOURS,
DAVID TOAL NAR 1414
WOODBERRY FOREST SCHOOL,
VIRGINIA

DEAR DAVID:

THANK YOU FOR YOUR MOST INTERESTING LETTER. WE HERE AT ESTES INDUSTRIES ARE ALWAYS PLEASED TO HEAR OF A GROUP THAT HAS MADE SUCH EXCELLENT PROGRESS. COULD YOU SEND US SOME INFORMATION ABOUT THE UNDERWATER LAUNCH.

DAVID TOAL SENT US FULL PLANS ON HIS "THE ORANGE AND BLACK" UNDERWATER ROCKET. HERE IT IS, IF YOU, TOO, WANT TO TRY AN UNDERWATER LAUNCHING.

THE ORANGE AND BLACK
(AN UNDERWATER ROCKET)
BY DAVID TOAL, NAR 1414

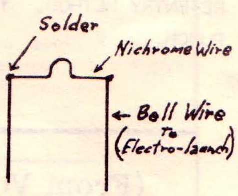


PARTS LIST
NOSE CONE, 261-BNC-1
BODY TUBE, 261-BT-3
LAUNCHING LUG, 261-LL-1A
3 FINS, 261-BF-1

THE PARTS FOR THIS ROCKET ARE ABOUT THE SAME AS FOR THE ASTRON SCOUT. CARE MUST BE TAKEN TO GLUE THE NOSE CONE VERY SECURELY IN PLACE. TWO OR THREE COATS OF FIRE PROOF AND WATERPROOF GLUE MUST BE USED, FOR THE ROCKET MUST BE COMPLETELY WATERPROOF TO LAST FOR ANY NUMBER OF LAUNCHINGS. THE ROCKET EMPLOYS THE FEATHER-WEIGHT RECOVERY SYSTEM.

PREPARING UNDERWATER IGNITION

FIRST STEP: MAKE A GOOD STRONG CONNECTION OR SOLDER THE BELL WIRE TO THE ENDS OF A TWO INCH PIECE OF NICHROME WIRE, 261-NW-1A. ATTACH THE OPPOSITE ENDS TO AN ELECTRO LAUNCH.



SECOND STEP: WRAP A 1/2" PIECE OF JETEX AROUND THE CENTER OF THE NICHROME WIRE AND INSERT INTO THE ENGINE NOZZLE.

THIRD STEP: DRIP MELTED PARAFFIN ON THE NICHROME ASSEMBLY. DO NOT USE REAL HOT WAX. KEEP DRIPPING WAX UNTIL IT IS LEVEL WITH THE END OF THE ENGINE. NO NICHROME SHOULD STICK OUT OF THE WAX (ONLY THE BELL WIRE).

FOURTH STEP: NOW INSERT ENGINE AND IGNITION ASSEMBLY INTO THE ROCKET BODY. APPLY A THIN UNIFORM LAYER OF WAX BETWEEN THE END OF THE ENGINE AND THE END OF THE ROCKET BODY. THIS HOLDS THE ENGINE IN PLACE (THE ENGINE SHOULD SLIDE FREELY IN BODY TUBE BEFORE WAXING) AND WATERPROOFS THE INSIDE OF THE ROCKET.

FIFTH STEP: PLACE ROCKET ON A LAUNCHING ROD AND TAPE BELL WIRES FROM ROCKET TO THE ROD ABOUT FOUR INCHES FROM THE END OF THE ROD. THIS WILL HOLD THE ROCKET. CONNECT BELL WIRE TO ELECTRO LAUNCH. INSERT LAUNCHING ROD AND ROCKET INTO WATER WITH THE TIP OF ROD PROJECTING OUT OF THE WATER. FIRE AT WILL. THE FIRING MAY TAKE A LITTLE LONGER BECAUSE OF THE COOLING EFFECT OF THE WATER ON THE NICHROME WIRE.

(EDITOR'S COMMENT: TIME HAS NOT ALLOWED US TO FLIGHT TEST DAVID'S DESIGN. IT WOULD SEEM THAT A MORE SATISFACTORY UNDERWATER ROCKET COULD BE BUILT ALONG THE LINES OF THE PEE WEE WHICH APPEARED IN THE OCTOBER, 1961, ISSUE OF THE MODEL ROCKET NEWS. THE PEE WEE IS DESIGNED FOR A FEATHERWEIGHT RECOVERY WITH A BLUNT NOSE CONE, WHILE THE ORANGE AND BLACK WOULD HAVE A POINTED CONE, WHICH IS NOT RECOMMENDED FOR THE 'FEATHER WEIGHT' SYSTEM.)

(From Volume 2, Number 1)

THE FOLLOWING IS A REPRINT OF AN ARTICLE WHICH APPEARED IN THE JANUARY ISSUE OF THE "AEROSPACE" PUBLICATION. THIS WILL GIVE YOU A BETTER UNDERSTANDING OF WHAT THE SITUATION MAY BE LIKE IN A FEW YEARS IF OUR PRESENT SCIENTIFIC PROGRAM IS NOT INCREASED.

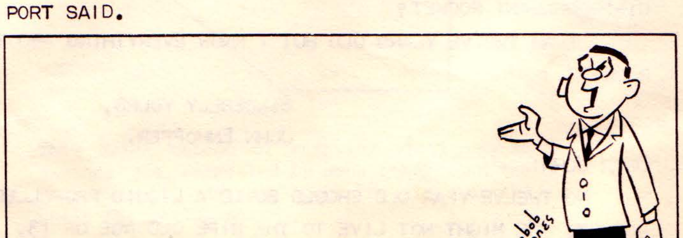
Foundation Reports USSR Leads U. S. in Scientific and Technical Graduates

THE NATIONAL SCIENCE FOUNDATION SAYS RUSSIA IS PRODUCING TWO TO THREE TIMES AS MANY SCIENTIFIC AND TECHNICAL PROFESSIONAL GRADUATES ANNUALLY AS THE UNITED STATES, AND THE SOVIET PACE IS EXPECTED TO ACCELERATE THROUGHOUT THIS DECADE.

IN AN ANALYSIS OF SOVIET EDUCATION, THE SCIENCE FOUNDATION FOUND THAT THEIR EDUCATIONAL SYSTEM REFLECTS "THE TOTAL SOVIET COMMITMENT TO DEVELOPING SCIENCE AND TECHNOLOGY AS ECONOMIC AND POLITICAL WEAPONS OF THE STATE."

THE RUSSIAN EMPHASIS UPON SCIENCE AND TECHNOLOGY IS SEEN BY THE FACT THAT 57 PER CENT OF ALL 1959 SOVIET GRADUATES AT THE BACHELOR'S LEVEL WERE IN ENGINEERING, SCIENCES, AND SELECTED APPLIED SCIENCE FIELDS. IN COMPARISON, ONLY 24 PER CENT OF THE UNITED STATES GRADUATES RECEIVED DEGREES IN THOSE FIELDS.

WHILE THE INSTRUCTIONS IN FUNDAMENTALS OF SCIENCE AND ENGINEERING WAS FOUND TO BE EXTENSIVE IN RUSSIA, CURRICULA WERE DIRECTED TOWARD NARROWLY DEFINED SPECIALTIES FOR THE PURPOSE OF EQUIPPING THE INDIVIDUAL STUDENT TO PERFORM SPECIFIC TECHNICAL AND SCIENTIFIC JOBS, THE REPORT SAID.



"What's so fascinatin' about space?"

(From Volume 2, Number 3)

MODEL ROCKET GLOSSARY

Acceleration: The rate of increase in the speed of an object. Acceleration is generally measured in terms of "G's," one "G" being the rate at which a dropped object accelerates under the force of gravity, or 32 feet per second per second.

Accelerometer: A device for the measurement of acceleration.

Average Thrust: The total impulse of a rocket engine divided by its time duration; this is the thrust that an engine would have if its thrust were constant from ignition to burnout.

Blow Through: An engine failure in which the nozzle is retained and the propellant blown out the forward end of the casing. Lower stage engines have a certain amount of blow through designed into them to provide hot gases for the ignition of the following stage.

Booster: A separate, detachable portion of a rocket containing its own engine, used to impart an initial velocity to the rocket before the ignition of the upper or main portion of the rocket. The booster separates from the rocket when the following portion is ignited. For further information, see technical report TR-2.

Boost Glider: A rocket design type which ascends vertically during the powered phase of its flight and becomes a gliding object after the activation of the ejection charge.

Burnout: The point at which a rocket engine ceases to produce thrust; generally the point at which all propellant has been burned.

Burnout Velocity: The speed of a rocket at the time of burnout.

Burnt Weight: The weight of a model rocket engine alone after all propellant has been expended. The weight of a model rocket engine after propellant, delay, and ejection charges have been expended.

Center of Gravity: The point in a rocket around which its weight is evenly balanced. The point at which a model rocket will balance on a knife edge.

Center of Pressure: The center of all external air pressure on the complete rocket including the body and fins. See TR-1

Chamber Pressure: The pressure exerted on the walls of the combustion chamber of a rocket engine by the burning propellant gases. Usually measured in pounds per square inch.

Cluster: A group of rocket engines set up to work as a unit. The total thrust of a clustered unit is equal to the thrust of all the individual engines added together.

Deceleration: The rate of decrease in the speed of an object. Deceleration is generally measured in "G's."

Delay Charge: A slow-burning chemical composition loaded into a model rocket engine during manufacture to provide a time delay between burnout and the activation of the recovery system.

Direct Ignition: A system of igniting the rocket engine propellant grain which is completely electrical, using no fuse, squib, or wick.

Drag: Aerodynamic forces acting to slow an object in flight. Because of their low weight to area ratio and high velocities, model rockets are especially susceptable to these forces.

Ducted Propulsion: A system of producing thrust in which air is drawn into a tube and accelerated by the exhaust gases of the engine to increase the thrust normally given by the engine. Any propulsive system which passes the surrounding atmosphere through a channel or duct while accelerating the mass of air by a mechanical or thermal means.

Duration: The length of time during which a model rocket engine produces thrust. The length of time during which a model rocket is airborne.

Elevon: The control surface on a single wing boost glider. This surface is designed to change, upon activation, the attitude of the craft from a stable rocket to a gliding object.

Ejection Charge: A gas generating charge loaded into a model rocket engine by the manufacturer to produce a rapid generating of gas pressure for the purpose of activating the recovery system.

Engine Block: A hollow bulkhead placed in a model rocket body to prevent the engine from moving forward during acceleration while allowing a free forward travel of the ejection charge.

Exhaust Velocity: The speed of the exhaust gases of a rocket engine. May be determined by multiplying the specific impulse of the engine times the acceleration of gravity (32 ft/sec/sec).

Fin: An aerodynamic surface projecting from the rocket body for the purpose of giving the rocket directional stability.

Igniter: An electrical device which initiates the combustion process in a rocket engine.

Ignition: The instant at which a model rocket engine begins to produce thrust.

Jet Pump: A method of model rocket propulsion in which air is ducted in towards the exhaust of the engine and heated to add to the engine's thrust. (Also see Ducted Propulsion.)

Krushnik Effect: The loss of effective thrust from a model rocket engine occuring when the engine is recessed forward in the body tube more than one diameter of the body.

Loaded Weight: The weight of a model rocket engine with propellant, delay charge, and other chemical and integral physical components in place, but without igniter.

Mach Number: The ratio of the speed of an object to that of sound in the medium being considered. At sea level in air at the normal atmospheric pressure a body moving at a Mach number of one (M-1) would have a velocity of approximately 1100 feet per second, the speed of sound in the air under those conditions.

Momentum: The impetus of a moving object; equal to its velocity times its mass.

Multi-Stage Rocket: A rocket having two or more engines, each used during a different portion of the flight. (Also see Booster.)

Nozzle: The exhaust duct of a rocket engine in which the gases are accelerated to higher velocities.

Nozzle Blow: A model rocket engine failure in which the nozzle is forcibly expelled from the rear of the engine.

Payload: The load to be lifted by the rocket; not a functioning part of the rocket.

Payload Capsule: A compartment in the rocket designed to hold and protect a payload.

Peak Thrust: (Also Max Thrust) The greatest amount of thrust developed by a rocket engine during its firing.

Pound Seconds: The measure of the total impulse given by a rocket engine. It is determined by multiplying the average thrust times the total burning time.

(Continued on page 8)

(Continued from page 7)

Propellant Weight: The weight of the propellant in a model rocket engine.

Recovery System: A device incorporated into a model rocket for the purpose of returning it to the ground in a safe manner. All model rockets must employ recovery systems.

Reynolds Number: A dimensionless ratio used in predicting changes in the flow characteristics of air about an aerodynamic surface. For further information, consult the Aerodynamics section in your encyclopedia.

Shock Cord: An elastic cord used to attach nose cones and parachutes to a model rocket body and to absorb the shock force of the ejection charge.

Sounding Rocket: A research rocket used to obtain data on the upper atmosphere.

Specific Impulse: The ratio of fuel consumed to thrust developed, determined by dividing the total impulse by the propellant weight. The higher the specific impulse, the more efficient the engine will be.

Stability, Inherent: The tendency of a rocket having the proper center of gravity / center of pressure relationship to maintain a straight course despite rotating forces caused by variations in streamlining, pressure, etc. (See TR-1 for additional information.

Static Firing: A test of a rocket engine in which the engine is restrained from leaving the ground. Static firings are conducted for the purpose of determining an engine's performance and reliability characteristics.

T-Max: The time from the instant of ignition to the instant of maximum thrust.

Telemetering System: A means of measuring, transmitting, and receiving data from the rocket while in flight.

Throat: The portion of a rocket engine nozzle having the smallest cross-sectional area.

Thrust: The propulsive force developed by an operating rocket engine, caused by the rearward ejection of gasses during the combustion process.

Thrust-Time Curve: A graphic expression of the relation of thrust produced by a rocket engine to the time during combustion. A graph showing the thrust produced by a rocket engine at each instant of its firing.

Time Delay: The time between burnout of a model rocket engine and the activation of the ejection charge.

Total Impulse: The total amount of thrust developed by a rocket engine, determined by measuring the area under the engine's thrust-time curve or by multiplying the average thrust by the burning time.

Trajectory: The path followed by a ballistic object under free-flying conditions. Strictly speaking, a model rocket does not follow a trajectory, as its direction and rate of travel are determined more by atmospheric conditions. A model rocket is instead said to have a flight path.

Whamadoodle: Any object for which the model rocketeer cannot remember the proper name.

(From Volume 2, Number 3)

Writer's Program Announced

In order to encourage the development of the literary skills needed by America's future scientists in the communication of their ideas, the Model Rocket News announces that effective immediately, contributors will be paid for articles published by means of certificates redeemable for model rocket supplies from Estes Industries. The value of these certificates will be determined at a rate of 2¢ per word as published.

Among the subjects which will be considered for publication are technical reports, news stories, explanations of various facets of space science, and reports on various model rocket construction projects. The rocketeer is encouraged to submit any article which he feels will be of general interest to other modelers.

Manuscripts should be typed double spaced on 8½" x 11" paper, and cannot be returned unless accompanied by sufficient postage. All articles must be accompanied by a statement signed by the contributor, and if he is a minor, by his parent or guardian, certifying that the article is his own original work. Articles published become the property of the Model Rocket News. The Model Rocket News reserves the right to edit or alter any articles published, and will not be responsible for lost manuscripts and photos.

(From Volume 2, Number 2)

Guppies Into Inner Space —or— There's Something Fishy There

by Terry Schmidt

It looked like a good day. The clouds had cleared and the sky was inviting. Two guppies about 3/4" long had been obtained two days before, and they appeared strong and ready for the trip. It was Saturday, February 2, and the early morning hours were spent in last minute preparations and calculations. All rocketeers arrived at launch site, and after a few delays, we were ready to launch.

The rocket was taken out to the triple launching device and assembled on pad three. The treated water, boiled to remove the impurities and poured back and forth between two containers to absorb oxygen, was poured into the capsule. The two guppies were taken from their transport van and the nose cone was fitted on. The capsule was sealed and the ignitor put in place. A picture was snapped and the countdown started.

Time was running T minus 60 seconds. The observer was in position and the recovery crew was waiting with portable vans full of water. At T minus 15 seconds the toggle switch to the battery was thrown and the circuit was ready. Then at T minus one second the firing button was pressed, and a second later the rocket was up there at a high altitude.

The sections of the rocket separated at peak altitude and started falling. The capsule was equipped with a parachute and the booster section with a streamer, but neither one appeared at this time. The parachute finally was spotted, gently floating to the earth, while the capsule tumbled down in free - fall at an increasing speed. Would the plastic chamber bread at impact, spilling the fish out on the ground? Would the impact shock kill the small passengers? Or did the acceleration already kill them?

The capsule hit the earth. We ran over and picked it up. The capsule was not broken but it was almost completely filled with bubbles. The larger of the two fish was lying in an inverted position, apparently dead. The capsule contents were emptied into a van full of water. One of the fish, the smaller one, appeared to be all right, because he started swimming around, but the other turned over on her back and sank to the bottom.

We took her out of the water and fanned her, then dipped her back into the water. Her side flippers moved. We took her out and repeated the fanning and dipping, and after five minutes she was swimming again, but in an inverted position. This process continued every fifteen minutes and after a few hours she swam and acted normally again.

Any day now she will give birth to a whole school of little guppies. This should set a new kind of record: These will be the youngest guppies in the world with astronautic experience.

Estes Industries Technical Report TR-3

ALTITUDE TRACKING

Single Station Tracking

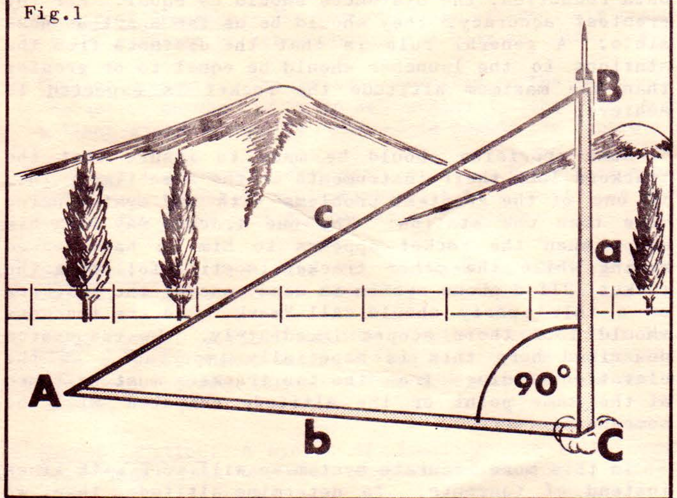
Every Rocketeer asks the question: "How high did it go?" However, previously few model rocketeers had the facilities to determine altitudes with any reasonable degree of accuracy. Some have attempted to find the altitude achieved by their rockets by the use of a stop watch, but this method is so highly inaccurate that the computed altitude may fall anywhere within 200% of the actual altitude. Several years of experience among model rocketeers have proven that optical systems are the only practical means for finding altitudes with any reasonable degree of accuracy.

The use of an optical tracking system requires the use of mathematics. The particular field of mathematics which is used the most in altitude computation is trigonometry. While this field is normally considered an advanced high school subject, any rocketeer can master its basics and apply them to his rocketry activities. If the rocketeer masters a few simple processes, he is ready to solve almost any problem in altitude computation.

One of the first principles of trigonometry is that all of the angles and sides of any triangle can be found if any three of its parts, <u>including</u> one side are known. Now every triangle has six parts: three angles and three sides. So if we know two angles and one side, we can find the other angle and the other two sides.

In determining the height of a rocket we collect two types of data: Distances and angles. This data is used to create a triangle which is a model of the lines which would join the tracker and the rocket, the rocket and a point directly below it on the ground, and the point on the ground and the tracker.

Fig.1



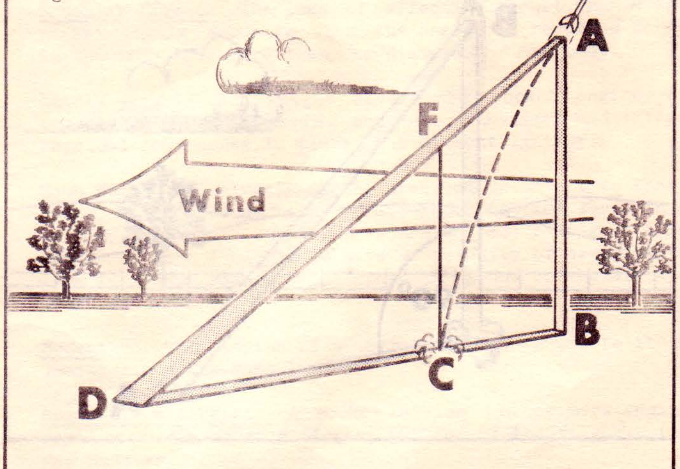
In the diagram above, point A represents the tracking station, B the rocket at its maximum altitude, and C a point on the ground directly below the rocket. The angle formed by the lines at C is then a right angle or 90°. Since there are 180° in the angles of a triangle, if we know angle A, we can find angle B, since $B = 180° - (A + C)$, or $B = 90° - A$. (In trigonometry, a capital letter represents an angle, a small letter represents a side. The small letter "a" will always be used to represent the side opposite angle A, "b" the side opposite B, etc. Two capital letters together represent a distance. Thus BC represents the distance from angle B to angle C, or side "a."

At the firing range, A is found by the tracker when he locks his scope at the rocket's peak altitude. If we now know the distance from A to C, or side b of the triangle, we can find side c and side a. Side a is the one in which we are interested: It is the height of the rocket. This of course assumes that angle C is a right angle.

Now if we only use one tracker, we have the problem of knowing only one angle and one side. This is not enough information to solve the other sides of the triangle. However, we can guess at one of the unknown angles, and obtain a good approximation of the height achieved by the rocket.

If only one elevation tracker is used, it is a good idea to station it at a right angle to the wind flow. For example, if the wind is blowing to the west, the tracker should be either north or south of the launcher. In this way we will keep the angle at C as close to a right angle as possible. By experimenting with a protractor and a straight edge, the rocketeer can demonstrate why the error would be less if the tracker is on a line at a right angle to the flow of the wind.

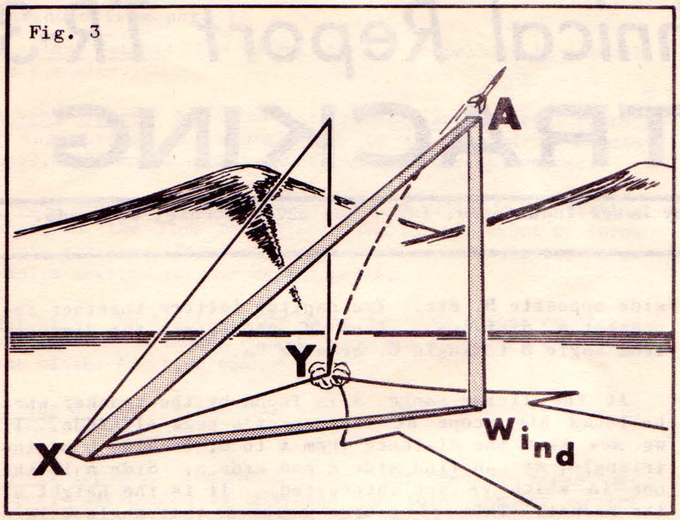
Fig. 2



In the diagram above, the wind is blowing from B to D. The rocket is launched at point C, weathercocks into the wind, follows approximately line CA, and at its maximum altitude is at point A. If the tracker is downwind from the launcher, he will see the rocket at point F, and compute the altitude as the distance from C to F. So his computed altitudes will be considerably lower than the true altitudes. On the other hand, if the rocket drifts toward him, his computed altitude will be considerably higher than the true altitude.

However, if the tracker is at point X in figure 3 and the launcher at Y, then the rocket will appear to be at point A as in figure 1, although the distance from the tracker to point A will be slightly greater than the baseline used in computing the altitude, the error will not be nearly as great. Also, the small additional distance will serve to make altitude readings more conservative, as the baseline will be increased.

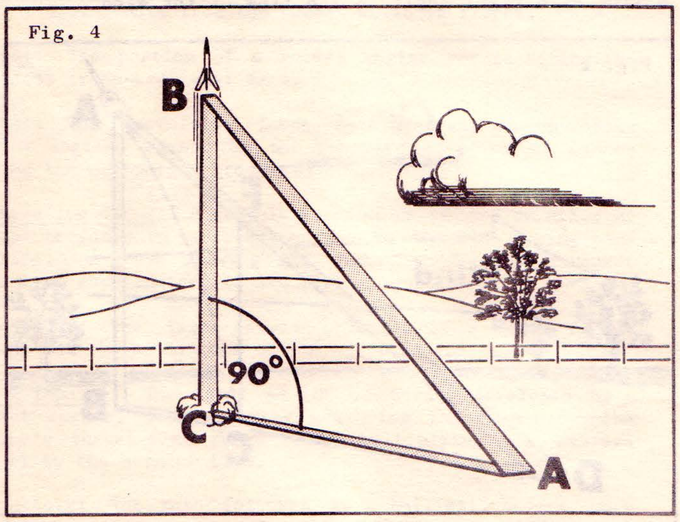
Fig. 3



So by observing the proper relation between wind direction and the position of the tracker, we can generally determine with 90% or better accuracy the altitude the rocket reaches from data given by only one elevation tracker. Of course, the closer the rocket flight is to the vertical, the more accurate will be the figures obtained. Thus on a calm day with a good model, we can approach almost perfect accuracy.

The method used to determine altitude with one tracker is outlined below. Bear in mind that this system assumes that the flight will be almost vertical, if not completely vertical. The rocketeer would do well to master this system before going on to more complex systems, as this method is used as a part of the more involved procedures.

Fig. 4



If we assume that the rocket flight is vertical, we can call angle C a right angle (90°). In that case, B is equal to 90° - A (the sum of the angles in a triangle is 180°, half of this or 90° is taken by angle C). Then to find the distance from C to B or the height the rocket reached we take the tangent of angle A (abbreviated tan) times the distance from the tracker to the launcher (side AC of the triangle). For example, if the distance from the tracker to the launcher (baseline) is 250 feet and the angle observed by the tracker at the rocket's maximum height is 62°, we will look in the table of trigonometric functions and find the tangent of 62°. The tangent in this case is 1.88, so we multiply 1.88 times 250 to find our altitude, which is 470'. Altitudes for model rockets are normally rounded off to the nearest ten feet. If the calculated altitude had been 332 feet we would have rounded it off to 330 feet.

Why do we use the tangent to determine altitude? The tangent of an angle is the ratio of the opposite side to the adjacent side, or in other words, the opposite side divided by the adjacent side. In this case, the adjacent side is the distance from the tracker to the launcher, and the opposite side is the distance from the launcher to the rocket's maximum altitude.

Kind souls of many years ago were nice enough to determine the tangents for all angles of right triangles, so we have a table which lists them. Since the tangent of the angle equals the opposite side divided by the adjacent side, or in the case of our first example, 470 divided by 250, by multiplying the quotient times the divisor we find the dividend. In our case, the quotient or tangent is 1.88, the divisor 250, and the dividend 470.

Summary

(1) In single station elevation tracking, we make sure that the line from the tracking station to the launcher is 90° from the direction of wind flow.

(2) The angle of flight is assumed to be vertical.

(3) The tracking scope is locked at the rocket's maximum altitude, the angle read, and the tangent of the angle found.

(4) The tangent is multiplied times the distance from the tracker to the launcher, giving the rocket's altitude.

Two Station Tracking

A higher degree of accuracy is possible when two elevation tracking stations are employed. In such a case, we will have triangles with 2 angles and one side given, enabling us to determine the other parts of the triangle without guesswork.

When using two trackers without azimuth readings the tracking stations are set up on opposite sides of the launcher. Preferably, to obtain the greatest accuracy, the stations should be in line with the wind, unlike the system used in single station tracking. Thus, if the wind is blowing to the south, one station will be north and the other south of the launch area.

The distance between the two trackers is not critical. One might be 100 feet from the launcher and the other 500 feet away. However, for the greatest ease in data reduction, the distances should be equal. For the greatest accuracy, they should be as far apart as possible. A general rule is that the distance from the stations to the launcher should be equal to or greater than the maximum altitude the rocket is expected to achieve.

Some provision should be made to insure that the trackers lock their instruments at the same time. This is one of the greatest problems with any system using more than one station: The one tracker may lock his scope when the rocket appears to him to have ceased rising while the other tracker is still following the rocket. If a phone system is used, one of the trackers or a third party should call "mark," and the trackers should lock their scopes immediately. In the system described here this is especially important, as the elevation readings from the two trackers must be taken at the same point or the altitude computed will be somewhat incorrect.

In this more accurate system we will work with sines instead of tangents. To determine altitude, then, we will first have to find the unknown sides of the triangle, as we have no right angles to work with.

For example, stations A and B are located on a 1000' baseline with the launcher between them. Station A calls in an elevation of 34°, and station B calls in an elevation of 22°. The total of these two angles is 56°, so angle C, located at the peak of the rocket's flight, is equal to 180° - 56°, or 124 degrees. We now have 3 angles and one side to work with. Our first step will be to list the angles and their sines. Since the sine

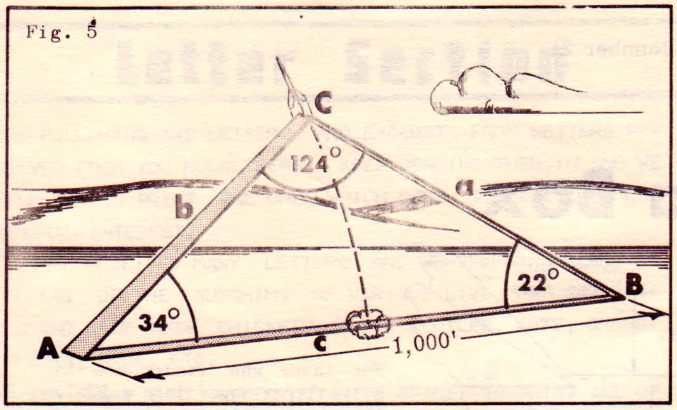


Fig. 5

of any angle greater than 90° is equal to the sine of the supplement of the angle, the sine of 124° is equal to the sine of 180° - 124°, or 56°.

Angle A = 34°	Sine A = .5592
Angle B = 22°	Sine B = .3746
Angle C = 124°	Sine C = .8290

The law of sines states that $\frac{c}{\text{SinC}} = \frac{b}{\text{SinB}} = \frac{a}{\text{SinA}}$ c = 1000', sinC = .8290 Therefore, $\frac{1000}{.8290} = \frac{b}{.3746} = \frac{a}{.5592}$ Pulling out the slide rule, we determine that $\frac{1000}{.8290} = 1205$. So we have a dividend, divisor, and quotient. In solving for side b, our dividend is b, our divisor .3746, and our quotient 1205. To find the dividend we multiply the divisor times the quotient. Now .3746 times 1205 = b, and pulling out the slide rule again, we find that b = 451. The same process is repeated to find side a: $1205 = \frac{a}{.5592}$, a = 1205 x .5592, a = 674'. So we now have the three sides of the triangle.

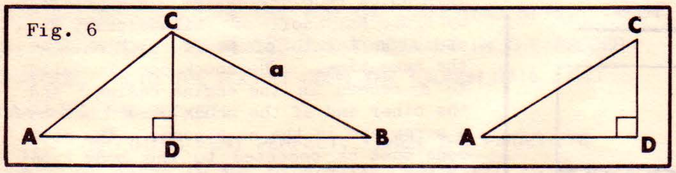


Fig. 6

The altitude of the rocket is then the distance from C to D in the diagram above. The angle formed by the meeting of lines AB and CD is a right angle. Since the sine of an angle in a right triangle is the relation of the opposite side to the hypotenuse, and since we wish to determine the value of the opposite side, we find that the sine of A (34°) is .5592. Hence $.5592 = \frac{a}{451}$, since $\text{SinA} = \frac{\text{opposite side}}{\text{hypotenuse}}$. .5592 x 451 = 252, hence CD = 252', and we now know the altitude reached by the rocket was 252'.

Fortunately, our computations to determine the altitude of the rocket can be simplified. To find the altitude we need only determine one of the unknown sides of the original triangle. So if we find the distance BC (side a) on the triangle, we can multiply it times the sine of B to find the height CD.

So $\frac{c}{\text{SinC}} = \frac{a}{\text{SinA}}$. Since we have found $\frac{c}{\text{SinC}}$ equal to 1205 when C = 124°, $\frac{a}{\text{SinA}} = 1205$. Then 1205 x SinA= side a = 674'. Now we have the one needed side of the triangle, so we can solve for distance CD in the right triangle BCD. The sine on an angle is equal to its opposite side divided by the hypotenuse, so we take the sine of B, which is .3746, times the hypotenuse, or 674' to find the opposite side CD. Thus .3746 x 674 = 252'.

The complete series of computations then would be $\frac{c}{\text{SinC}}$ x SinA = a, and a x SinB = CD. However, if we can combine the formulas to make one formula, we can speed up our work considerably. Now $\frac{c}{\text{SinC}}$ x SinA = A, so we can substitute the expression ($\frac{c}{\text{SinC}}$ x SinA) for a in the formula a x SinB = CD. Our formula then becomes $\frac{c}{\text{SinC}}$ x SinA x SinB = CD. One of the basic rules of algebra tells us that if the dividend is multiplied by a number and the result divided by the divisor, the result is the same as if the division were carried out first and the quotient multiplied by the number. For example, $\frac{10 \times 4}{5} = 8$, and $\frac{10}{5} \times 4 = 8$.

So we can change the expression $\frac{c}{\text{SinC}}$ x SinA x SinB = CD to read $\frac{c \times \text{SinA} \times \text{SinB}}{\text{SinC}}$ = CD. So by performing two multiplications and one division, we can find the altitude of the rocket. The division of SinC into the expression (c x SinA x SinB) can occur at any point, as $\frac{c \times \text{SinA}}{\text{SinC}}$ x SinB = CD, and c x $\frac{\text{SinA} \times \text{SinB}}{\text{SinC}}$ = CD also. This last form of the equation will give the same result as the first, and actually involves the same steps, but is generally easier to use.

Summary

(1) In two station tracking without the use of azimuth readings we station the trackers on a base line approximately equal to twice the altitude the rocket is expected to reach.

(2) The trackers are located in line with the wind.

(3) The scopes are locked at the rocket's maximum altitude, the angles read, and the sines of the angles found.

(4) The altitude is computed by the formula height = $\frac{c \times \text{SinA} \times \text{SinB}}{\text{SinC}}$, when A and B are the angles read by the trackers, c is the baseline distance, and C is the third angle formed by the meeting of the lines of sight of the two trackers.

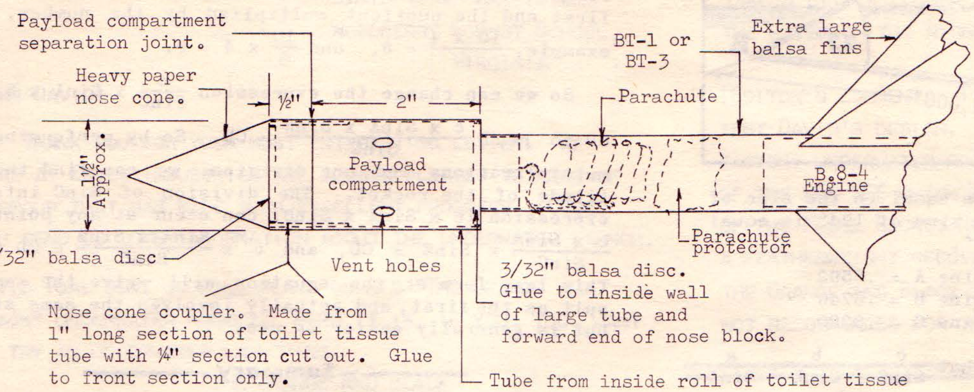
Sines and Tangents

∠	sin	tan	∠	sin	tan	∠	sin	tan
1	.02	.02	28	.47	.53	54	.81	1.38
2	.03	.03	29	.48	.55	55	.82	1.43
3	.05	.05	30	.50	.58	56	.83	1.48
4	.07	.07	31	.52	.60	57	.84	1.54
5	.09	.09	32	.53	.62	58	.85	1.60
6	.10	.11	33	.54	.65	59	.86	1.66
7	.12	.12	34	.56	.67	60	.87	1.73
8	.14	.14	35	.57	.70	61	.87	1.80
9	.16	.16	36	.59	.73	62	.88	1.88
10	.17	.18	37	.60	.75	63	,89	1.96
11	.19	.19	38	.62	.78	64	.90	2.05
12	.21	.21	39	.63	.81	65	.91	2.14
13	.22	.23	40	.64	.84	66	.91	2.25
14	.24	.25	41	.66	.87	67	.92	2.36
15	.26	.27	42	.67	.90	68	.93	2.48
16	.28	.29	43	.68	.93	69	.93	2.61
17	.29	.31	44	.69	.97	70	.94	2.75
18	.31	.32	45	.71	1.00	71	.95	2.90
19	.33	.34	46	.72	1.04	72	.95	3.08
20	.34	.36	47	.73	1.07	73	.96	3.27
21	.36	.38	48	.74	1.11	74	.96	3.49
22	.37	.40	49	.75	1.15	75	.97	3.73
23	.39	.42	50	.77	1.19	76	.97	4.01
24	.41	.45	51	.78	1.23	77	.97	4.33
25	.42	.47	52	.79	1.28	78	.98	4.70
26	.44	.49	53	.80	1.33	79	.98	5.14
27	.45	.51				80	.98	5.67

For angles of 81° through 89° the sine is .99, the sine of 90° is 1.00. Tangents over 80° are not given, as no sensible data reduction is possible for angles that great.

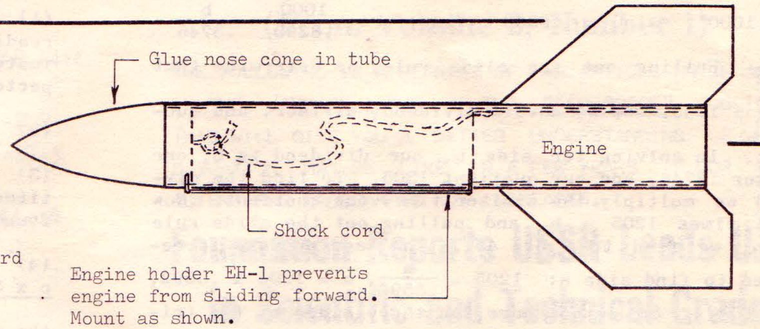
(From Volume 2, Number 2)

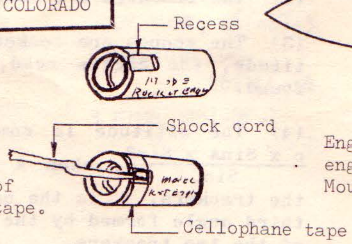
The Idea Box



For those who wonder how to get a large mouse into a BT-1, there's this live payload compartment suggested by Doug Ritz, Lititz, Penna. One toilet paper roll, one nose block, and some balsa is all it takes.

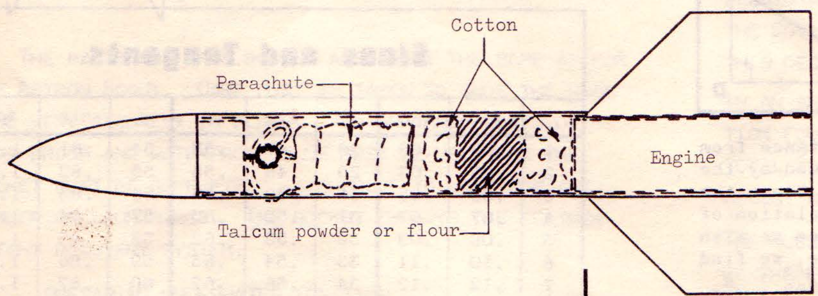
GOT SOME MORE IDEAS?
SEND THEM IN TO THE MODEL ROCKET NEWS
BOX 227
PENROSE, COLORADO



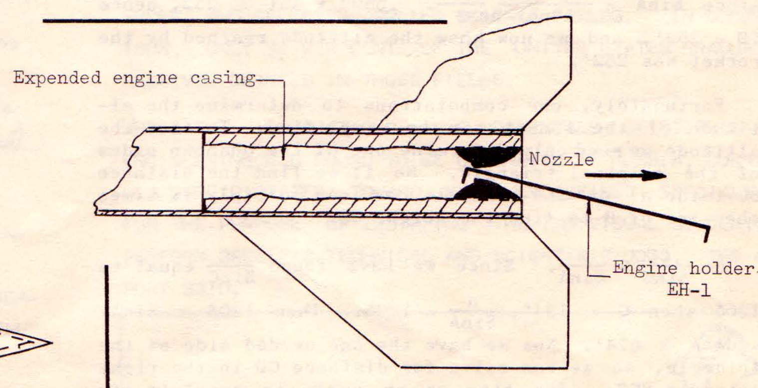


Cut small recess on outside of engine casing as shown. Attach shock cord in recess using cellophane tape. For extra strength double shock cord back over first layer of tape and then apply second tape.

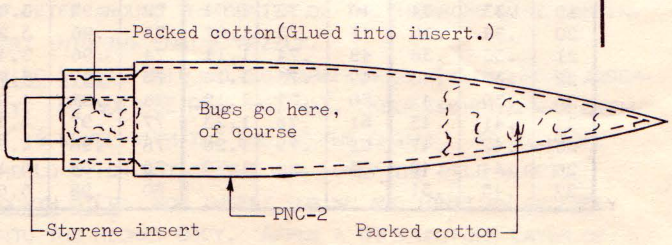
This quick recovery system was suggested by Bruce Maryanoff of Philadelphia, Pa. and Leon Laszlo of Dearborn, Mich. at the same time. The shock cord is taped to a recess in the engine casing, and the other end of the shock cord tied to a screw eye in the nose cone. The nose cone must be cemented to the body tube if the system is to function properly.



To make his rockets easier to spot, Richard Reynolds of Minneapolis, Minn. puts two tsp. flour behind the parachute. No yeast.

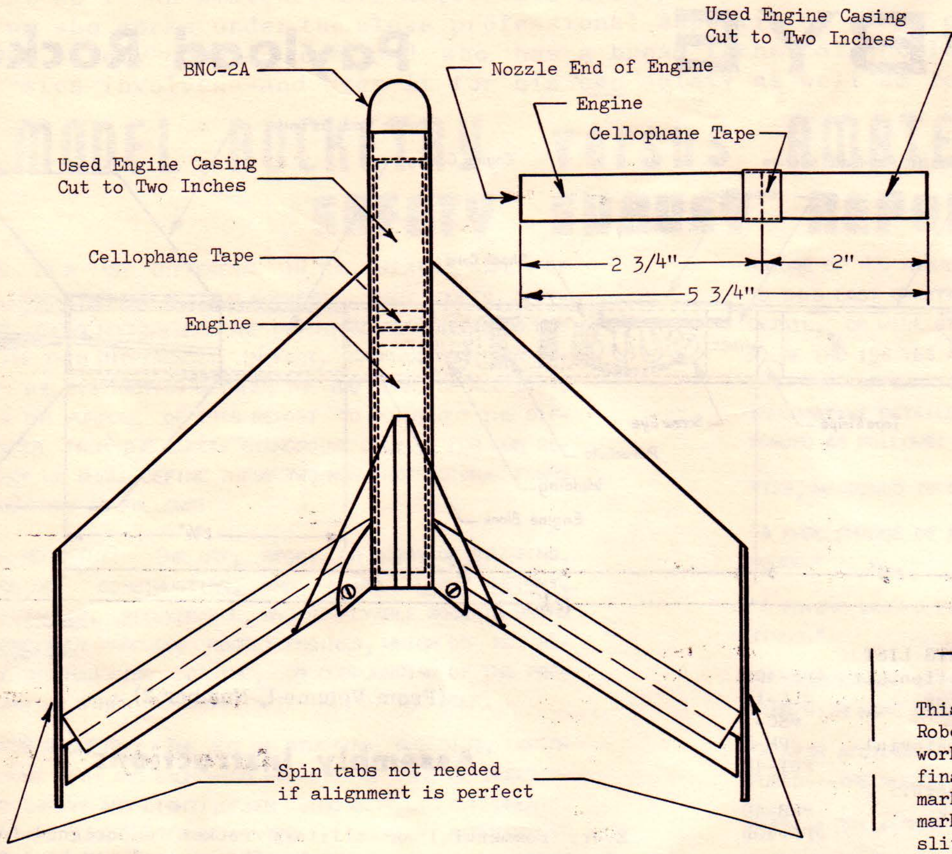


This quick method of removing spent engine casings was suggested by none other than the Boss himself. He just hooks the wire in, and pulls the engine out.



This quick capsule for bugs comes from Mike Dorffler, Hastings, Neb.

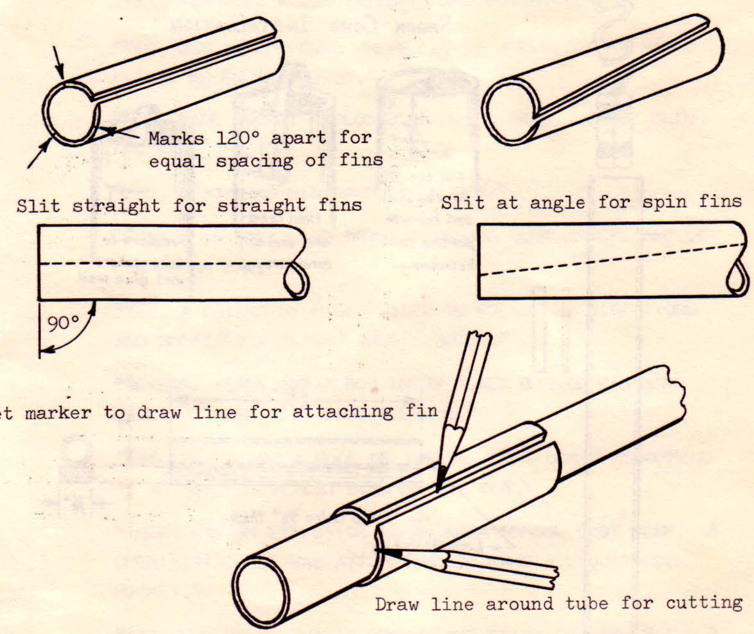
The Idea Box

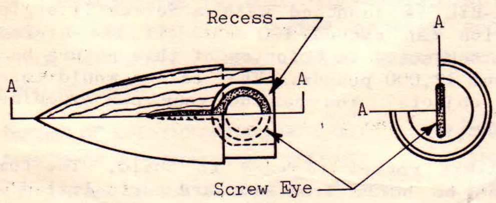


Here are the modifications which were made in the Space Plane that set the world's record at NARAM-4. A BNC-2A is glued in, replacing the BNC-3A, the nose block is left out, and a two inch section of a used engine is taped to the front of the engine to provide additional stability and to space it down in the body. Make sure that the added section of casing is not obstructed so the ejection gases have a free travel.

Spin tabs can be left off if the wing alignment is perfect, and the elevons will require only a very small up setting for proper glide. A good glide will require careful setting of the elevons, and glide testing should be carried out thoroughly. It may be necessary to weight the nose by attaching a small sliver of lead to prevent stalling. In a good glide the Space Plane will be just barely under the stall point.

This body tube marking guide, suggested by Robert Simpson, Laurel, Md., makes short work of cutting body tubes and aligning fins. Drawing around the end produces a mark for cutting body tubes squarely, the marks at the end give fin spacing, and the slit is used to get the fins on straight.

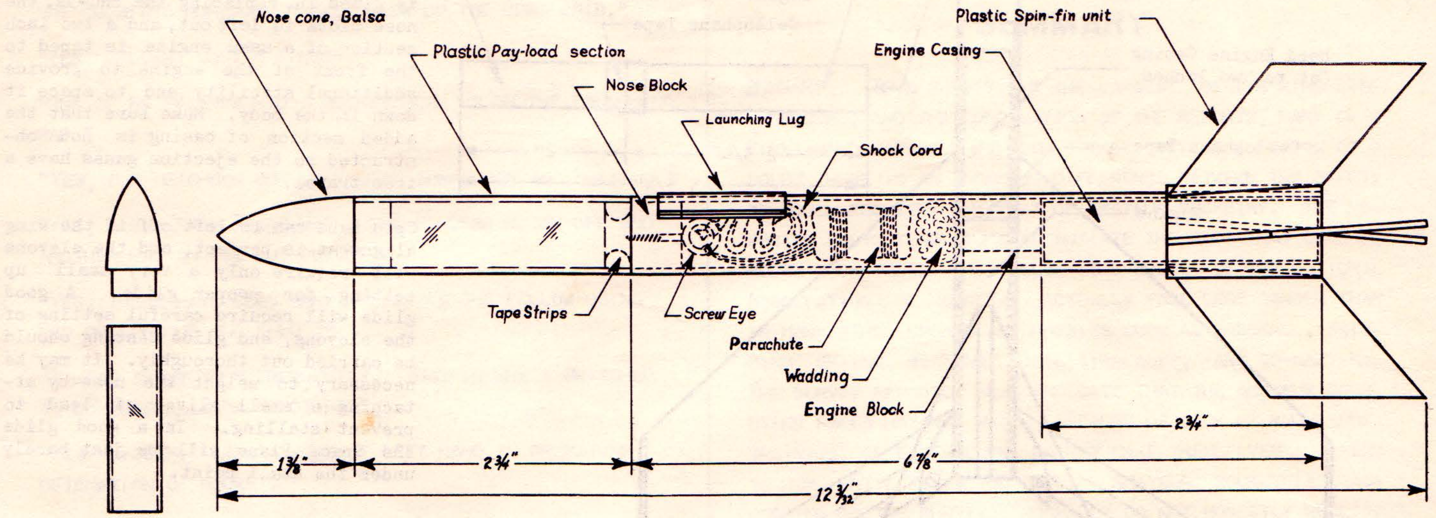


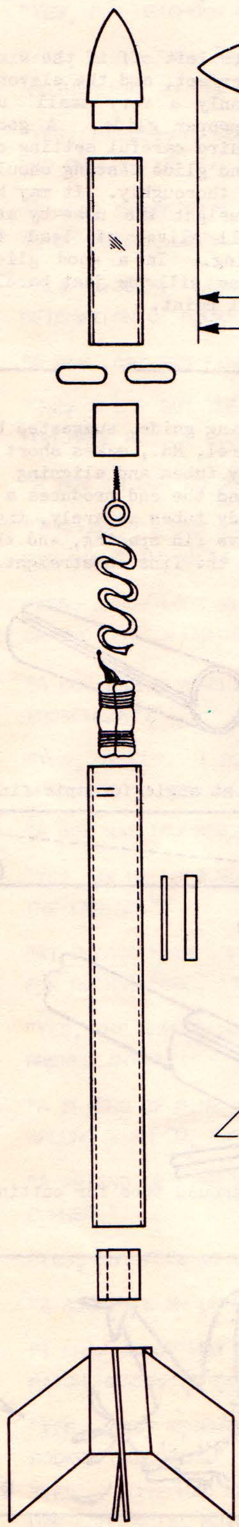


For a more compact rocket, Terry Schmidt of Paradise, Calif. suggests hollowing out the base of the nose cone with a knife, inserting the screw eye, and attaching parachute and shock cord. For added strength, screw the eye in place, remove, inject white glue into the hole, replace the eye, and let dry.

Estes Industustries Rocket Plan No. 4

BUG-A-BYE Payload Rocket

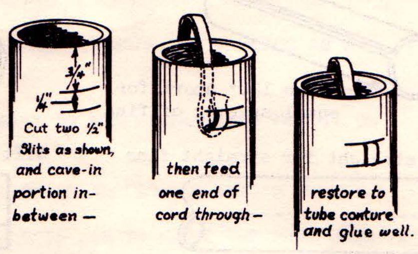


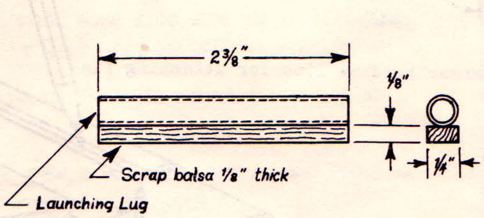


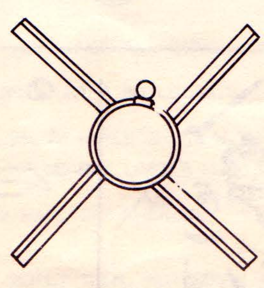
PARTS LIST

1-Payload section kit	#PS-40A
1-Launching lug	#LL-1B
1-Shock cord	#SC-1
1-Parachute material	#PM-1
1-Body tube (Cut to length.)	#BT-40
1-Engine block	#EB-40
1-Fin set	#PF-40B

SHOCK CORD INSTALLATION







(From Volume 1, Number 2)

Assembly Instructions

Every commercial or military rocket is designed for a purpose--to carry a payload. The payload may be a camera, hydrogen bomb, mail sack, radio transmitter, animal or man. Regardless of the payload requirements, however, a rocket can be designed to do the job.

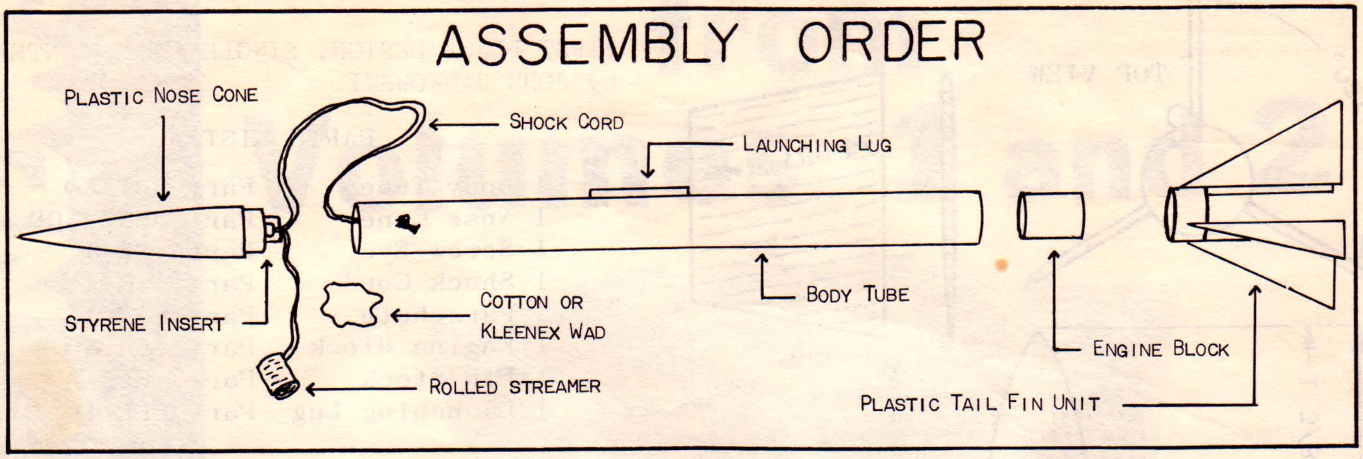
The BUG-A-BYE rocket has been designed for its special purpose, the study of the effects of acceleration on small objects, including biological specimens. When the BUG-A-BYE is launched with a Series II engine the acceleration can exceed 100 G's. If the average man were to be subjected to G forces of this nature he would weigh about 17,000 pounds. What effect would this have on other objects? You can do your own experimenting and find out.

The BUG-A-BYE rocket is easy to build. The complete rocket can be built from standard parts listed in our current catalog. For constructing the rocket it has been found that white glue is best.

First spread glue around the inside of one end of the body tube as far in as you can reach with your little finger. Then push the engine block into the end of the tube and push it forward until it is 2-3/4" from the end.(An engine may be used to push the block into place. Push in until the end of the engine is even with the end of the tube, then remove the engine immediately.) Do not pause during this operation or the engine block may become stuck in the wrong position.

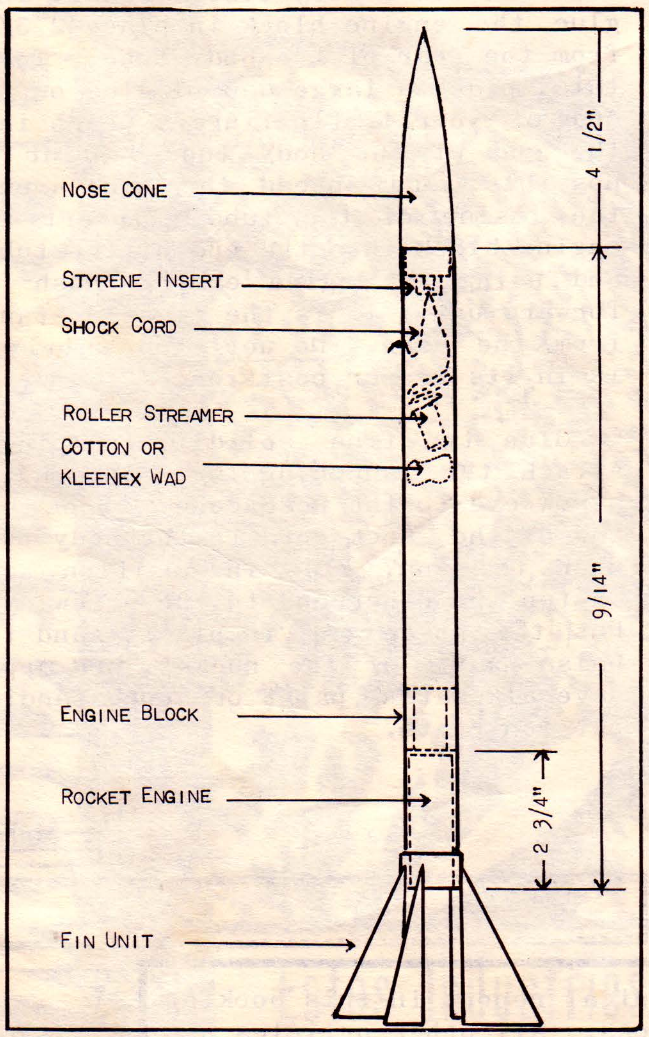
Glue the launching lug in place as shown in the drawing. Assemble the payload section according to the directions that accompanied it. Attach the shock cord and recovery system as shown in the drawing. The fin unit should be attached as shown in our catalog. If you are using a Series II engine be sure the fins are secured very tightly. Under acceleration of 100 G's they will have 100 times their normal weight. If they should come off your rocket could be damaged, and someone could be hurt if it hit him. The nose cone should fit tightly. If it is too loose wrap its shoulder with tape to increase the diameter. The maximum payload weight for this rocket is one ounce.

Dirty Bird III



PARTS LIST

VINYL PLASTIC NOSE CONE - PART #PNC-2
BODY TUBE - PART #BT-1
SHOCK CORD - PART #CR-1 OR #SC-1
STREAMER MATERIAL - PART #SM-1
PLASTIC FINS - PART #PF-1
ENGINE BLOCK - PART #EB-1
LAUNCHING LUG - PART #LL-1B



DIRTY BIRD III

THE DIRTY BIRD III, DESIGNED BY G. HARRY STINE, PRESIDENT OF THE NAR, IS ONE OF HIS FAVORITES, AS IT IS SO VERY EASY TO FLY AND ASSEMBLE. HERE IS HOW IT IS DONE. . .

FIRST CUT A BODY TUBE 9 1/4" IN LENGTH. THEN GLUE THE ENGINE BLOCK IN PLACE AT A DISTANCE OF 2 3/4" FROM THE REAR OF THE BODY TUBE (SEE ILLUSTRATION). TO DO THIS, PLACE A LARGE DAB OF GLUE ON THE END OF YOUR LITTLE FINGER. REACH THROUGH THE END OF THE BODY TUBE AND SPREAD THE GLUE AROUND THE INSIDE OF THE TUBE AS FAR FORWARD AS POSSIBLE. BE VERY CAREFUL NOT TO GET ANY GLUE NEAR THE END OF THE TUBE. INSERT THE ENGINE BLOCK IN THE END OF THE TUBE AND USING AN ENGINE CASING PUSH IT FORWARD UNTIL IT IS 2 3/4" FROM THE REAR. WHEN INSERTING THE ENGINE BLOCK <u>DO NOT STOP</u> UNTIL IT IS IN ITS PROPER POSITION. SOME GLUES SET VERY QUICKLY, AND STOPPING FOR A MOMENT MAY CAUSE THE BLOCK TO SET IN THE WRONG PLACE. BE SURE TO IMMEDIATELY REMOVE THE ENGINE CASING.

PUNCH A SMALL HOLE IN SIDE OF THE BODY TUBE ABOUT 1" FROM THE FRONT END. THEN TIE A KNOT IN ONE END OF THE SHOCK CORD, AND PUT THE OTHER END DOWN THROUGH THE HOLE IN THE BODY TUBE. REACH IN AND PULL THE SHOCK CORD THROUGH UNTIL THE KNOT COMES UP SNUG AGAINST THE BODY TUBE. PLACE THE STYRENE INSERT INTO THE NOSE CONE AND TIE THE MIDDLE OF THE SHOCK CORD TO THE EYELET. USE A TAPE DISC TO ATTACH THE OTHER END OF THE SHOCK CORD TO A 12" LENGTH OF STREAMER MATERIAL. CAREFULLY ALIGN AND GLUE THE LAUNCHING LUG TO THE SIDE OF THE BODY TUBE ABOUT HALF WAY ALONG THE TUBE. AFTER PLACING AN ENGINE IN THE END OF THE BODY TUBE, PUT ON THE TAIL FIN UNIT. TO ASSURE A TIGHT FRICTION FIT, IT MAY BE NECESSARY TO WRAP THE END OF THE BODY TUBE WITH SCOTCH OR MASKING TAPE.

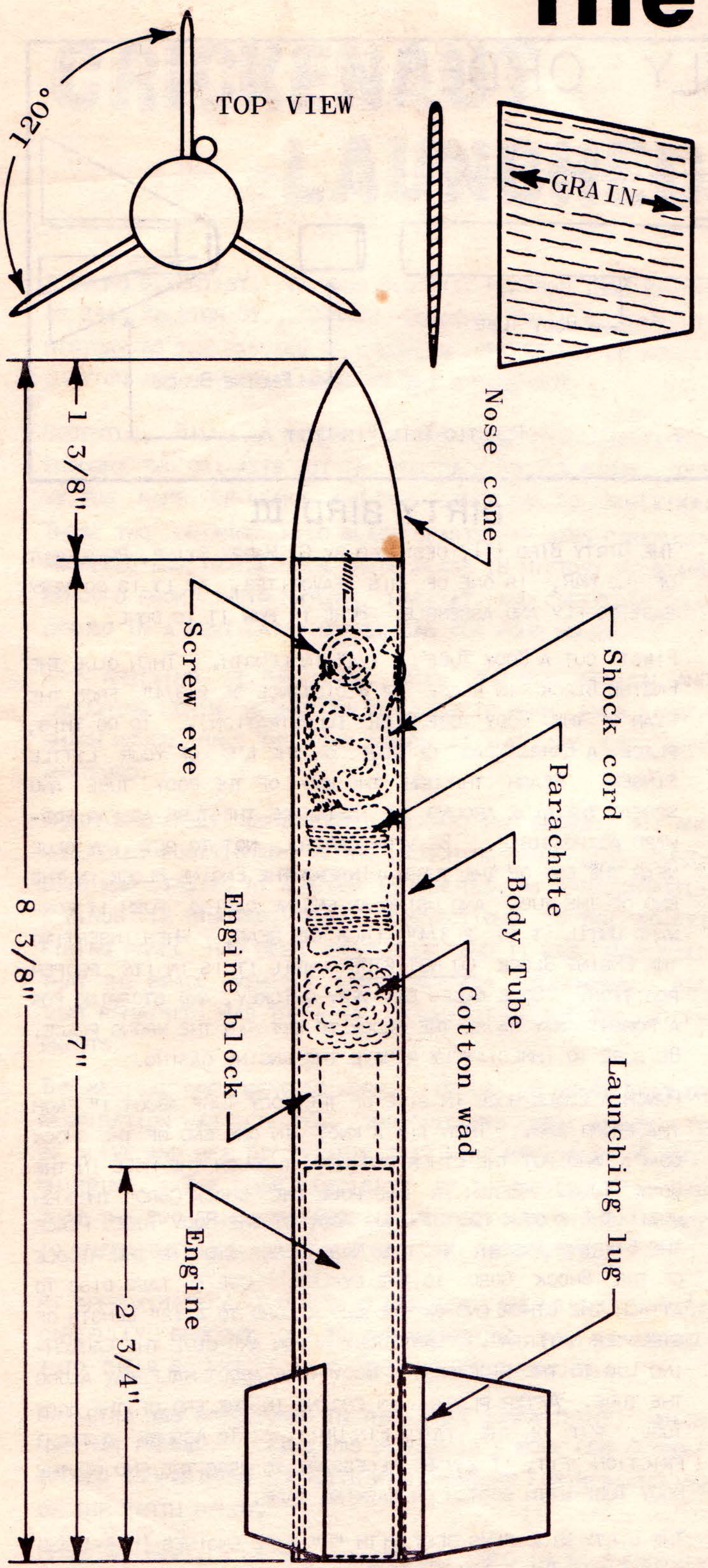
THE DIRTY BIRD FLYS BEST WITH "B" TYPE ENGINES (B.8-4 AND B 16-5). THE A.8-3 IS FINE IF YOU HAVE A LIMITED FLYING AREA OR DON'T WANT TOO MUCH PERFORMANCE. MAKE SURE THE FINS FIT VERY TIGHTLY WHEN YOU USE THE B 16-5 ENGINE.

LAUNCH THE DIRTY BIRD III FROM ANY STANDARD MODEL ROCKET LAUNCHING DEVICE. THIS MODEL WILL GIVE YOU MANY HOURS OF FLYING PLEASURE AND IS NEARLY INDESTRUCTABLE.

(From Volume 2, Number 2)

the Cloud Buster

FIRST PLACE DESIGN, SINGLE STAGE CONTEST
by JOHN JANKOWSKI



PARTS LIST

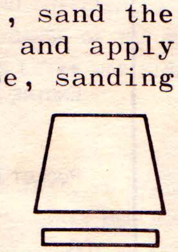
1 Body Tube	Part #BT-30
1 Nose Cone	Part #BNC-30D
1 Screw Eye	Part #SE-1
1 Shock Cord	Part #SC-1
1 Parachute	Part #PM-1
1 Engine Block	Part #EB-30
1 Fin Stock	Part #BFS-20
1 Launching Lug	Part #LL-1B

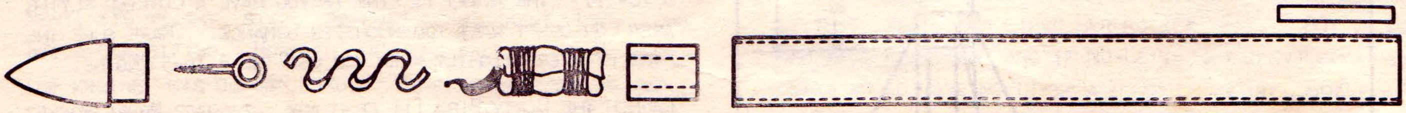
Use B.8-6 engines
for flights over 1000'.
(Be sure engine is secure
in body tube.)

ASSEMBLY INSTRUCTIONS

First cut a body tube 7" long. Then glue the engine block in place 2 3/4" from the rear of the body tube. To do this, place a large dab of glue on the end of your little finger, reach into the end of the body tube as far as possible, and spread the glue around the inside of the tube. Insert the engine block into the end of the tube, and using an engine casing push it forward until it is the right distance from the rear. Do not stop until it is in its proper position.

Glue the fins solidly in place. Attach the launching lug. Attach the screw eye to the nose cone. Hook one end of the shock cord to the body tube near the top, glue in position, and fasten the other end to the screw eye. Put the nose cone in place, sand the balsa parts of the rocket, and apply several coats of paint or dope, sanding between coats.





The rocket plans and technical report in this booklet are the current revised versions; all other articles are reprinted as they originally appeared.