10 February 1957

Orville Carlisle
420 Norfolk St.
Norfolk, Nebr.

Dear Orville:

The box of rockets arrived fine yesterday. Today, we had beautiful weather with very light breezes and clear skies, so we tried them out.

I fired off five about 10 A.M. There was 100% reliability in parachute ejection. Charge 7 in a Mark II gave about 1000 feet altitude going off the adjustable launcher with the long rail. So I called the man down at the Physical Science Lab at the college who is project engineer on the Pogo rocket. Pogo is a solid propellant rocket about 12 feet long and six inches in diameter. It fires out of ~~mx~~ simple launching tower on a truck and goes to better than 50,000 feet. At this altitude, it coughs up a silvered, radar-reflecting parachute for target use. The Pogo man was most impressed when seven rockets went up with 100% parachute ejection. It's a lot better than they've been doing with Pogo.

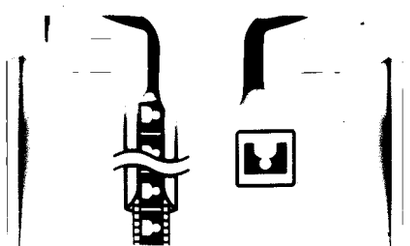
The rockets worked beautifully, even with the FFF9 charges. The Pogo man took one along with several Charge 7's and FFF9 charges to show at the lab tomorrow.

This afternoon, we got off about ten more with myself and the man who is head of the project section of the Missile Flight Safety Office. About two dozen kids showed up, making safety a real problem. Everything went fine until the last two rockets, which sort of failed.

We had a burn-through with a Charge 7 unit. The wall of the tube burned right through in two places. (See sketch). Of course, it also burned right through the side of the rocket airframe at that point. The flight was rather spectacular; the rocket sort of pinwheeled right off the top of the launch rail. The parachute ejected, however, and the unit fell from about twenty feet with the chute open. The airframe was a total washout, although we salvaged the chute and nose cone assembly.

The last shot of the afternoon was a charge 7 in a Mark II. It experienced a pre-mature parachute ejection under thrust about ten feet off the launch rail. The shock cord broke, of course, but the junk rose to nearly 100 feet. At this point, the chute deployed with the nose cone under it, while the rocket body free-fell back to the ground. The chute ended up a half-mile away in ~~mx~~ a 13,000 volt high-line; we didn't even try to get it down.

Also had a partial ejection during the afternoon, probably due to faulty parachute rigging by me. The chute deployed, but the wrapper and end cap remained hung in the rocket



body. For some strange reason, this flight also washed-out an airframe, since the booster blast caught one of the fins afire. Thanks for the extra fins, because the unit is now repaired and will fly again.

Several suggestions were put forth during the day's operations. First off, I added an aluminum flame deflector to the launcher. (See sketch.) It worked fine and kept the dust and flying gravel out of the air when a rocket took off.

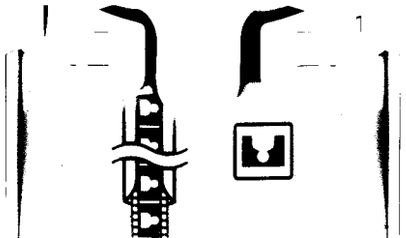
The "Viking" type unit exhibited very low dynamic stability during its first two flights until we tried packing the chute as far forward as possible. This brought the center of gravity further forward. The measurements I made on the unit indicate you have what we term a "one caliber" shift of the center of gravity. That is, the distance between the takeoff and burnout CG's is about 1 inch, or the diameter of the missile. This is about the maximum that can be tolerated, by the way, so the unit is operating on the ragged edge. In addition, the cone-shaped nose does not lend stability to the unit; a cone tends to generate some lift at any angle of attack at all. A better arrangement would be an "ogival" nose (see sketch) which we are going to try.

I'm also building a unit with a higher "fineness ratiom", or length-to-diameter ratio. The Mark II is rather stubby, therefor requiring quite large fins. The size of the fins can be reduced to about the size of a Viking's if the fineness ratio is increased to at least 10. The unit I am building up has a diameter of 3/4 inch and a length of 11 inches. The big problem here will be repacking the chute and making smaller end cups to accomodate the smaller diameter airframe. This unit will have an ogival nose. We expect it to be lighter, simpler, and very stable.

To prevent the severe weathercocking you experienced in your motion picture and ~~xxx~~ which we also had in light winds, I added a set of brass spin tabs to the fins of one of the Mark II units. This generated a spin of about 10 rps and resulted in an extremely stable rocket with no weathercocking at all. She went straight up to about 1000 feet with an FFF9 charge, and this in about a 10 knot wind with a vertical launch. Spin stabilization, by the way, tends to remove a lot of instability in a rocket which results from thrust misalignment, ~~xxxxxxx~~ fin misalignment, and wind. It's like spinning a bullet. It also makes for a very spectacular flight.

These units of yours have a lot of soup to them. Thus far, we have found them very safe. When they malfunction, they go all the way and it is a very positive malfunction. They don't lay around and smolder. We are still wary of a blow, however.

The Pogo man thinks he would like to use the booster units to power small aerodynamic test models. This is something we haven't gotten around to trying yet, although we have shot



small aerodynamic test models aloft with longbow. Many times, we need to know the aerodynamic characteristics of a missile before we go to the expense of building the real thing; usually, we use models in a wind tunnel, but this can get to be expensive. I think your small rocket unit can be of real help in actual free-flight testing of aerodynamic models.

Everybody who saw these rockets perform down here was impressed today. The consensus of opinion is that you have done an excellent job of engineering and producing these rockets. With commonsense safety precautions, they are about as safe as any rocket can be.

I'm waiting now for the kit so we can pack some units of our own. First off, I want to try a model Aerobee using a booster under the unit. This will require a first stage with no delay charge and some method of insuring positive separation and positive ignition of the second stage. This can and has been done, and we do it all the time with the big ones. It means real altitude, about 5000 feet or better, with boosters such as yours.

A suggestion: Rohm and Haas make a little solid unit to use in demonstrating their propellants and missile designs. They have demonstrated these at Redstone Arsenal by flying them on a wire across the room (of course, there are now a number of holes in the walls down there!). The Pogo man had the following suggestion: he wants to use something like this to demonstrate his Pogo rocket without actually having to fire one. When a bevy of VIP's comes in, he can haul out his launcher, take them outside, and, regardless of the weather, put up a rocket with a chute. Here is one application of your units that probably hasn't come to mind yet. It might also be the answer to some of your production problems. If it is all right with you, I'm going to show this unit to some of the men from Douglas, Cooper Development Co., Aerojet-General, and so forth. They might be interested in them as small demonstration units as well as x producing them as toys.

Anothe comment that was passed today: "We ought to get this shoe salesman down here working for us if he can achieve 100% reliability on a chute ejection like this!"

You've got something, Orville. I'm writing Mechanix Illustrated to tell them about it. Also, if I can be of any further help to you on this thing, please let me know. I had more fun than a little kid out there today, and I shoot the big ones professionally, too. You'll have chutes popping all over the sky down here if you can get them out on the market.

Cordially,

G. Harry Stine