

5 March 1957

Dear Orville:

The express package full of boosters came today. Everything okay. Thanks a million.

The color high-speed motion pictures of the launchings at WSPG came back today and we reviewed them. Just as I suspected, the rockets are tipping off rather badly, as much as ten degrees. This is caused to a great extent to the "play" between the launching shoe, which has a bore of $3/8$, and the launching rail, which has a diameter of $1/4$. After seeing this, I flew some Mark II units off the special launcher using a $3/8$ dowel. Sure enough, they went true and straight. Suggest using a $3/8$ dowel for all high-powered stuff.

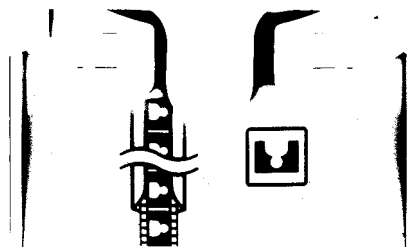
Also noticed from the high-speed photos that there was absolutely no flame from the rocket charge. This I checked several times. No flame at all. This indicates that you have an extremely efficient rocket motor, since all the combustion is taking place inside the motor. The only thing coming out is hot gas, which is as it should be.

I lost a unit today. It went up and out of sight, and came down inside the technical area at WSPG some two miles from the launcher. Needless to say, somebody picked it up before we got there to recover it! Some guy has a nice desk model now.

We have had absolutely no trouble with the high-powered loads. In the first place, we are keeping them cool, not letting them sit in the sun. Needless to say, keeping them cool slows down the rate of chemical action when they are fired. This does not seriously affect the performance.

The Wide Wide World show was pretty good, in spite of the fact that NBC hammed it up a little bit. There are hundreds of good stories going around at WSPG now, about how none of the TV boys would listen to our electronic experts. Sure enough, when a rocket took off, the noise and blast completely threw their cameras out of synch. They lost one camera and a mike. And they made the mistake of putting one camera and operator on top of a 90-foot telephone pole just outside the launching area. After that first Nike went, it shook him up pretty bad...and he wanted to get down off that crew's nest in the worst way. But nobody by that time wanted to exchange places with him. Needless to say, the whole TV bunch went away from WSPG as true believers; I think the guy on top of the pole was even a convert.

When one of these big, high-thrust solid propellant rockets takes off, the noise level is something terrific...much louder than anything else on earth. It contains every audio frequency from the sub-sonics clear up into the ultra-sonics. And it shakes the living hell out of you. I was once in the blockhouse behind ten feet of concrete when they fired a V-2; the noise level was so high that it made me sick to my stomach, and I was partially deaf for several hours. Working on the static test stands was



just as bad. I don't like it very much anymore and prefer to be some distance away to save what little hearing I have left in order to enjoy my hi-fi.

Perhaps it's also telling tales out of school, but the so-called impact explosions of the Honest Johns and Little Johns were four of the nicest TNT and phosphorus detonations I've ever seen. They mined that hill for days, and it is located ten miles behind the launchers! Came time for impact on the TV sesames screens, and some GI shoved down on a standard old dynamite plunger! What a boondoggle! But it made a good show.

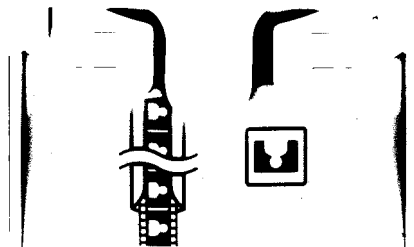
We never thought it would go off as well as it did. To prevent misfires, etc., we doubled-up on everything! There were two Corporal missiles sitting in the launching area, both running the same countdown. If #1 had failed to go (which it nearly did!), the firing crew for #2 would have fired. The same held for the Nikes and the rest. All communications lines and other equipment were also doubled as insurance. But everything went so well that we never had to call in the second team for anything.

Your estimate of WSPG being made for the storage and handling of explosives is correct. We treat all rockets as high explosive down here. Perhaps this is the reason for my extreme caution on the part of Rock-A-Chute, a reaction bred into me by five years at this place.

As for all the things said about me in MEN, ROCKETS, AND SPACE RATS, I'm sorry to report that they are true. Sometimes I wish they weren't. We no longer have Cosmo; he met his untimely end by arguing with a car and falling coming off on the losing end. Cosmo has been replaced by his double, Skitter -- otherwise known as Astronomical Skitterlated Jornada, since all cats must have three names. All the rest is true, although Lee Correy hasn't done much work lately. I ought to be working on a beak right now, but your damned rockets have me in their clutches.

You made a remark over the telephone Sunday night which brought to mind the fact that I have never extended a cordial invitation to visit down here and see White Sands. I'm quite serious. I don't know what good a trip would do insofar as Rock-A-Chute goes right now, but regardless of when you came, you would get the two-dollar tour of WSPG and, weather and the gods of rocketry permitting, maybe get the chance to see some firings. I'm quite serious about this invitation, so whenever you think you might want to come, just let me know.

Another thing occurred to me: a guy like you who has developed the kind of rocket hardware you have has no business in the shoe game. In spite of the fact that I need people like crazy, I haven't offered you a job because I don't think you'd want to work for Civil Service; they wouldn't pay you enough. But there are lots of other private outfits around.



As for whether or not the model spaceship I have could be powered by a Rock-A-Chute, I don't know. It is about 12 inches tall. The midships wings would complicate the stability problem to the point where I would hesitate to fire it vertically. It was meant strictly as a non-flying shelf model. If you'd like, I'll include a set of plans for it when I send you the sets of plans for Viper and Honest Abe in a few days.

I have not tried building the Parabee II yet, being forced by 8 hours work at WSPG to confine my missile building to about an hour a night. Parabee I #2 and #3 are just about completed, and I intend to try them out first. I have a 3-foot launching tower which will handle only 4-finned missiles, so I ~~may~~ may stick to Parabee I as my main effort and construct one or two Parabee II models for flight off a rail launcher. For the boosted version, I think I will stay with the 4-finned version for several reasons. First, the addition of the booster stage will move the center of gravity well to the rear, and unless I also move the center of pressure back also, I'll run into a stability problem. The center of pressure must always be behind the center of gravity in order to have a stable flight.

Center of gravity is determined by balancing the completed model on a knife edge. Two measurements of CG need to be made, one with a loaded ~~ammunition~~ charge, and one with a burned out charge. Both of these points should be forward of the center of pressure.

For a subsonic rocket, the center of pressure is equivalent to the center of lateral area. CLA and CP are determined by taking the outline of the missile on stiff cardboard, cutting it out, and balancing it on a ~~knife~~ knife edge.

Since all the air lift and drag forces operate through the CP while gravity works through the CG, I think you can see that the CP must always be behind the CG. The rocket will act as a free body and rotate always about the CG point. If the forces of lift and drag which determine its direction are behind this point, they will tend to correct for any rotation of the rocket about its CG.

Enough of the physics lecture and also this letter. I've got to get to work on a book.

Cordially,

