The Making of

Photon's In-Flight Rocket Video

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My desire to loft a motion picture camera in a rocket dates back to an early edition of the Handbook of Model Rocketry. Harry Stine had a short feature in it about a man who flew an 8mm film camera in a payloader on an F engine. It was about the neatest project a kid could want to do. Since then I've always envied the guys who used to own Cineroc's, that old movie camera by Estes. Doing a transmitter to downlink video to the ground always seemed too difficult for me. So I waited. Nobody really predicted the revolution the camcorder would bring to the world, or to rocketry.

I've been flying still cameras now for nearly 10 years. In that time I've made over 50 flights from H motors on up to a K. It took me a while to get around to it, but when I started building my Tripoli Level 3 rocket, I had in mind putting a camcorder in it from the start. "Photon" was built and I succeeded in my Level 3 attempt. Details of the construction and first flights of this rocket are available in another article in the same directory as this one.

To be sure, many others have flown camcorders. Some of their videos have even made it onto TV in various shows about rocketry. My good friend Kurt Guigisberg flew one in his "Big Dumb Rocket" and I helped convert the video to an AVI file so it could be available via the Internet. Still, I wanted to try it myself and to put my own techniques to the test.

Photon is 6" in diameter, and the payload section is two feet long, which allows plenty of room for a small camcorder. My old Sony Handicam was broken beyond repair, so I went shopping. It was very frustrating to say the least. This is yet another example of technology adding features to a product until it is no longer useful for a simple task. I checked dozens of stores and nearly every camcorder I found had a fold-out LCD screen. Most of them had no manual focus ring, relying exclusively on auto-focus. I finally found one I thought I could use, but it wasn't perfect.

What I picked out was a Samsung SCA20 8mm. It cost me $225 on sale. This was a bare bones unit, but it still had no way to manually lock the focus. I knew that the rapidly changing environment of a rocket was no place for auto-focus. I had to lock it on infinity. I tested the Samsung a few times and found out the auto-focus was useless; even pointing it at the horizon and holding it steady, the focus constantly moved in and out. After careful consideration I decided to open to camera. I found I could disconnect one of the motors on the lens assembly. Turned out that it was the right one, but at a cost; the lens would now only focus at one zoom position. Zooming in and out would bring the image into focus. I had to move the motor I disconnected slightly to get it at the right zoom position for my purposes, and then put everything back together.

Now I needed a carrier. Kurt had simply packed his camera in foam, which worked, but I wanted something sturdier. With the right motor, Photon would pass through mach, and the vibration would no doubt move the camera. Also, there was not room to put the camera in a horizontal position inside a 6" tube. The camera would have to point straight up and look out the side of the rocket via a diagonal mirror. The mirror and window would have to be quite wide keep from cutting off the edges of the image.

The first set of photos shows the carrier I built. It is bolted inside a Hawk Mountain G10 coupler, which slips into the payload section tube. This was done to provide something to bolt the window onto. The carrier itself is made from 1/8" G10 sheet and looks rather like one of my still camera holders. Two disks, front and rear, with rectangular flat pieces spacing them out. Everything is bolted together using ½x½" aluminum angle. The mirror holder is aluminum sheet. I stuck the first-surface mirror to

it with double-sided foam tape. After these photos were taken, some black paint was added here and there to cut glare.

The tripod mount keeps the camera centered in the holder. A small angle bracket provides some additional support. Not shown is the foam rubber I added to wedge the camera into place and keep the battery from falling out.

The coupler tube has several holes cut into it. The big rectangular one is, of course, for the mirror. A small round hole allows me to plug a video jack into the camera to see what it is doing. Another allows me to move the zoom lever, so I can focus the camera. The biggest round hole allows me to reach the controls to start and stop the camera. The video jack and control holes match up to holes in the airframe, so I can operate the camera while the rocket is on the pad.

The window is made from 1/8" polycarbonate. I made a couple of spares in case it gets scratched. I never put a window on any of my still camera rockets, but the hole was so big on this one that I felt it important to seal it on Photon. There is a slight bit of distortion caused by the curved plastic, but it was not noticeable in testing so I left it. The bolts go right through the airframe to the coupler tube, locking everything together. Total weight, ready to fly, is about 5 pounds.

The first flight of this camera was made at Roc Stock X, Lucerne Lake, CA, on November 13, 1999. This was the third flight of Photon. I chose an Aerotech M1419 motor. I had wanted to fly a full M1939 on this occasion, but simulations showed that it would put Photon well above the 10,000 foot window wavier obtained by ROC. So the short M was used. SHORT! This was to be my biggest flight ever. I would break nearly all my personal records with this one. Most expensive, most powerful, heaviest, and highest.

The button was pressed at 11:30 AM and Photon made a great flight. The only rub was that my dual-deployment failed; the main chute came out at apogee. Good thing there was little or no wind. Photon took about 5 minutes to float down and land about ½ mile away.

A video makes a perfect record of the movements of your rocket. From the ground Photon appeared to make a perfect straight up flight, but the video definitely shows something else. The camera was purposely aimed at the big camelback mountain on the north side of the lakebed. The rail was as straight up as we could make it. At ignition, the video jumps a little bit as vibration from the motor causes the rocket to "pogo" slightly. The ground drops away and Photon starts to roll, first right, then left as airspeed picks up. At the same time, the point of view shifts toward the mountains, as if Photon was moving horizontally across the lakebed.

All the way up, Photon continued it's slow roll to the left. The speed of this roll made a perfect pan shot of the area. By the time it reached peak it had completed only 1.5 turns. Here is the weird part: the camera tends to point down no matter which direction it is pointed in. The mirror is at a perfect 45° angle (I have checked it since the flight) so you would think that the horizon would rise and fall as the rocket turns. Unless the whole rocket is doing a little "pirouette" I cannot explain how it managed to take these great pictures.

A big part of what makes an in-flight video great is the sound. On this tape you can hear the "pop" of the igniter, followed by the slow build-up of the motor. The motor roars to life and is soon overcome by the sound of the air screaming past. The wind

diminishes slowly as the rocket peaks out. When the speed reaches a certain point, something causes a whistle effect. Then it is over.

The ejection comes at least a second early. I guess this was well within the limitations of the BSR AltAcc that controlled the charges. It was really too high to tell from the ground, even with binoculars, exactly what happened. But the main chute came out and the rocket floated down on both drogue and main. It appeared to be a very smooth ride, but the video shows otherwise. The ejection and deployment was violent enough to cause the tape tracking to be lost momentarily. You can hear the start of my "big rocket overhead" warning siren. The point of view swings wildly throughout the descent, enough to make you feel sick while watching it. There is a slight bump as the tail section, which was lowest, hits the lake bed. Then the payload section is down (a little jump in the tape there) and rolls to a stop pointing at the ground. It looked rather like a Mars Pathfinder photo about then.

I could not be more pleased with the results of this flight. I definitely plan on flying this video camera again, at least twice in the next year. If you think about it, though, it sounds really expensive. I made an AVI file for the Internet, which was about 30 seconds long. The M1419 motor cost me $300. That means this tape cost me $10 a second to make. OUCH! But it was worth it and I will do it again.

My thanks go to the ground crew: My son Chris Roberson, "uncle" David Moore, and his young friend Tom. Thanks also to Ron McGough, president of Rocketry Organization of California, for the use of his motor case and rail, and to the rest of ROC for putting on such a fine launch as Roc Stock.

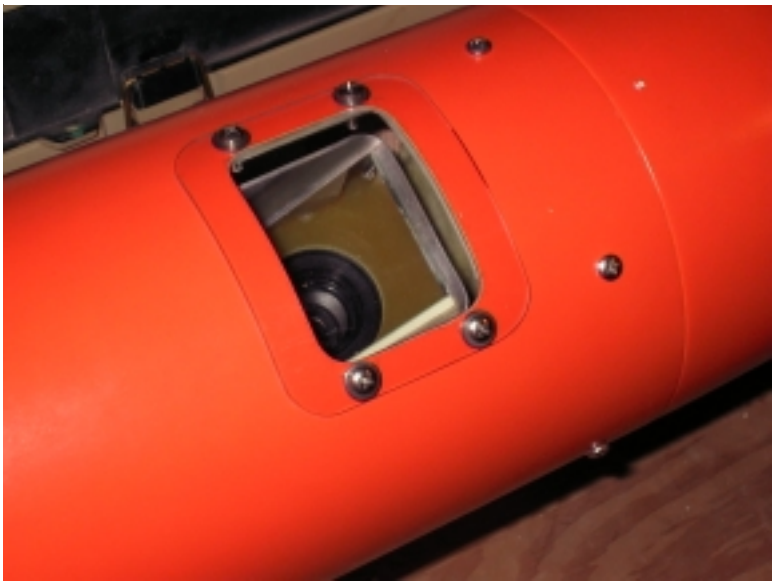
The AVI video file of this flight and other flights, and the construction article on Photon are available at:

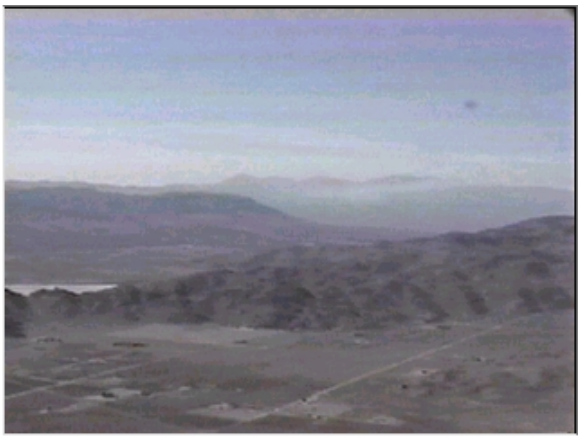
www.rocstock.org
www.winroc.org

And also on the Winroc CDROM.

The Samsung 8mm camcorder mounted in the carrier. The white tube slides over the carrier and adds strength to the payload section, which is weakened by the large window hole.

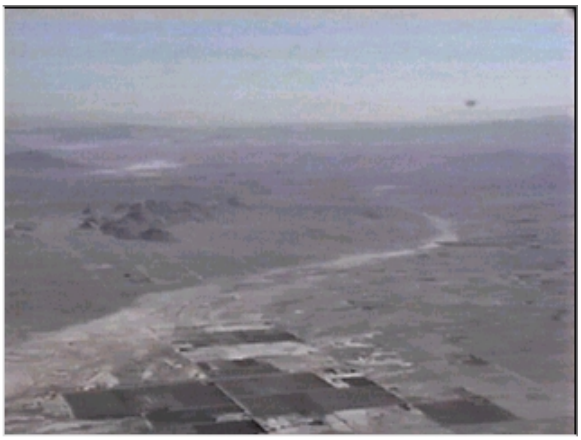
Details of the mirror holder and window assemblies.





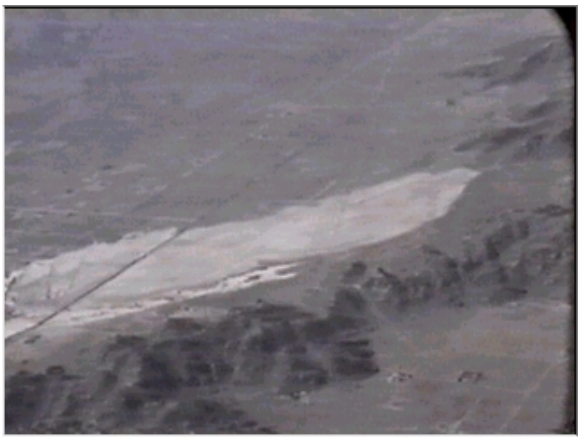
LIFTOFF! The hills drop away, revealing an adjacent lakebed and the San Gabriel mountains in the misty distance.

The town of Lucerne Valley is down there, with Big Bear and the San Bernadino mountains in the distance.



The dry lake of Lucerne has some drainage, which heads off to the southeast.

An instant before ejection: Photon has nearly peaked out and returns a nice shot of the San Gabriel mountains on the horizon.



After ejection, the camera swings past the small lakebed that is west of Lucerne. Highway 18 cuts across it next to a private airstrip.

The famous camelback mountain of Lucerne looks very different from over 9,000 feet.

These still images, captured from the AVI file, do not do justice to the original.
The real video footage is much more dramatic.

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