The War Wagon

As part of the preliminary studies for the Sierra Cooperative Pilot Project (SCPP) during the first season in 1976-77 I drove a trailer-mounted instrument to several locations in and around the foothills of the Sierra Nevada to explore the atmospheric stability in storms. We were concerned that seeding materials we wished to release from the ground might be trapped in the stable air which often forms upwind of mountains. We had found this to be a problem in the San Juan Mountains of southwestern Colorado during the San Juan Pilot Project.

The instrument I used was a vertically-pointing echo sounder which operated somewhat like a fixed-antenna radar. The sounder sent a sound pulse upward from a speaker and then listened for an echo to return from the air above. If the air was stable, the sound pulse would be reflected to the sounder and be recorded on a strip chart. If the air was unstable, there would be no echo. The time-delay of the returning pulse was calibrated on the strip chart in feet of altitude so that one could visualize the stable layers in the atmosphere above the instrument. By placing bales of straw around the sounder to block out extraneous sound, the instrument was sensitive to several thousand feet upward.

Interestingly, the sound pulse could be easily heard by the human ear. It sounded like the sonar pulse in an old submarine movie. A sound pulse would typically be sent upward every thirty seconds or so. When the instrument was operated near people in its mobile mode, curious passersby would occasionally approach the instrument with a puzzled expression and inquire about its purpose. When it was operated in remote areas of the Sacramento Valley at night, extraneous signals would frequently be recorded on the strip chart. These signals were later identified as low-flying geese responding to the sound. We were able to watch geese flying over the instrument when a pulse was emitted and hear the geese squawk back in response. When this occurred, we could see the geese's squawk recorded on the chart.

From these studies we determined that the air was frequently stable ahead of and during storm passages over the Sierra Nevada. However, rather than pooling upwind of the mountains, any seeding material we released would likely drift

northwestward along the foothills because a strong, low-level, southeasterly jet of air almost always exists ahead of a frontal passage. Following the frontal passage, a strong northwesterly jet of air also blows along the foothills from the opposite direction, but the air is almost always unstable then and the seeding material would not be trapped near the ground. Because of the predominance of stable air and strong low-level jets, most of the experimental designs in the SCPP relied on airborne releases of seeding material. Compensation for the strong winds and complicated trajectories required complex seeding patterns.

During one of my mobile explorations of atmosphere stability in a storm that first season I towed the echo sounder to the summit of the Sierra Nevada and through one of its major canyons. I had been issued a four wheel-drive truck in case I had to drive in snow or mud during my excursions. However, the truck was somewhat ancient. It was a 1954 Ford painted army green. Jim Moore, my field assistant, laughingly nicknamed the truck, *the War Wagon*, after the old John Wayne western of that name. Although it looked decrepit, it was in really good shape. One of the mechanics in the maintenance garage at the Bureau of Reclamation's Auburn Dam site had taken a loving interest in restoring the old truck. It performed the duties I required of it without a single problem or breakdown.

I headed up the mountain to take measurements early one evening. Since I was still living in Denver that first season and had to travel to California to take the measurements, I decided to spend most of the night in the storm to obtain as much data as I could. I didn't know the mountain roads very well because I had never lived in that part of the country. During the first part of the evening I traveled Interstate 80 eastward from Sacramento, California to Donner Pass taking measurements every file miles are so. I then traveled back down the highway westward to Auburn, California where I turned onto a two-lane, paved road to Forest Hill, California. Both I-80 and the road to Forest Hill were built on the ridges as many roads are in the Sierra Nevada.

I wished to take some measurements down in one of the canyons to see if the stability was stronger and would likely trap any seeding material there. I looked at the roadmap I had with me and found a black and white checkered road that traveled from Forest Hill to Colfax, California across a 3,000-foot deep canyon in which flowed the North Fork of the American River. The legend on my map said the checkered section was a twenty-mile long, improved, paved road. I decided this would be perfect for my measurements.

By the time I reached Forest Hill, it was about one o'clock in the morning and the few stores in town were closed and no homes showed any lights. It was beginning to rain lightly and the lowering clouds were drifting rapidly to the northwest on the low-level jet, upwind of the Sierra Nevada. The winds were gusty, and the forecast was for heavy rain during the night and possibly snow at this elevation by morning.

After several false starts, I found the correct turnoff which led into the canyon. As I headed out of town on the road to Colfax, I noticed numerous driveways leading off both sides of the road to mountain homes back in the trees. This was comforting since I could make a U-turn into one of these driveways, if necessary. Because of the length and awkwardness of my four wheel-drive truck towing a twenty-foot trailer with the echo sounder in a large cylinder about six feet in diameter and ten feet tall, I would have trouble turning around without some type of turnout.

The road continued out of town and slowly dipped downward through a Ponderosa Pine forest. Because of the darkness I couldn't see much more than what my headlights illuminated directly ahead. After about three miles the road turned to dirt and I noticed a wall of rock to my left where the road had been carved from the mountain. The road had steepened sharply, and I was heading downward on about a 10% grade. I suddenly realized that there were no more driveways off the road and, in fact, to my right was a short stone wall, and nothing

beyond. I stopped the truck and tried to peer out to the right. I couldn't see anything. I couldn't see anything to my left other than the cut into the mountain, about five feet from the truck.

I turned off the truck's engine and opened the window. Outside, the wind was blowing strongly, kicking up dust and twigs. I could hear the wind moaning in the trees above, somewhere. I decided I had better get out and look around. I opened the door and the wind almost blew it out of my grip. I carefully closed the door and walked over to the wall on the opposite side of the truck. As I approached the wall, I realized that I was on the edge of a cliff. But, because of the darkness, I could not guess how far down it was to the river. I picked up a fist-sized rock and tossed it over the edge. No sound returned from below. I didn't learn until several years later when I retraced my path on a family outing during the daytime that the canyon floor was almost 3,000 feet straight down at that point. I was at the topo of a series of zig-zags leading down to the American River far below.

I had gone about a mile down the road beyond any possible turn-arounds. I could not back a mile or more up the road. The only choice was to proceed on down the road. But, would it get any worse? If I walked out the way I had come, it would only be about three miles back into town. But, there was no one awake there now. Besides, if I left my truck parked in the middle of the road, no one could get by. So, I decided to continue slowly down the road until I came to a blockage. If I needed to, I could walk out for help at that point.

As I continued down into the canyon I noticed that some recent road work had been done in places. The road had been graded and was soft in these spots. If it began to rain soon, they could become loblolly's. I came to a switchback and slowly jockeyed the rig around the corner. I was barely able to keep the front wheels on the road without the trailer turning too sharply at the rear and the wheel rolling over the edge on the inside of the curve. There were three more of these switchbacks on the way to the bottom of the canyon. At two of them, I stopped and

collected measurements with the echo sounder, although I was losing interest rapidly in this whole enterprise.

Finally, at the bottom, the road leveled out and a steel bridge appeared in the headlights. The bridge had a wooden floor and was suspended on rickety-looking steel supports. I drove gingerly onto the bridge and stopped in the middle. I decided to collect a long sample of data from the center of the bridge, since this was the whole reason for making this trek in the first place. While the sounder did its thing, sending *beeps* into the sky, I stared over the edge of the bridge at the water rushing by below. The wind continued to howl overhead, and the bridge swayed slightly in the breeze. It was now approaching three o'clock in the morning and I was feeling very alone. After about fifteen minutes I decided I was going to drive out the north side of the canyon without stopping. After all, what more could I learn on that side, that I hadn't already learned. I was ready to get back to my motel and curl up in a nice, warm bed. This was getting a little too scary for me.

I buttoned up the sounder, got in the cab of my truck, and drove off the bridge. Just to the north of the bridge the road turned to mud. A bulldozer and a highway maintainer were parked to one side and I was barely able to squeeze by. The road was so soft that earlier trucks had left ten-inch ruts in the mud. Apparently, a spring had drained onto the road and turned everything to mud. The operators of the caterpillar and maintainer had done their best to service the road, but it would still be easy to get stuck here.

I stopped *The War Wagon* before it mired down. I climbed out and looked around. I noticed the road had been mounded up to try and drain the water off, but if one slid only slightly off the crown, he would be completely captured by the mud. Oh, well. There was no going back now. I engaged the hubs on the front wheels and climbed back into the truck. I stuck the gear shift into four-wheel drive and took a deep breath. I decided I only had one chance at this, so I might as well make it good. I let out the clutch and floored the accelerator. *The War Wagon*

lurched forward and began to pick up speed. Behind me the trailer bounced from side to side and threatened to slide down the embankment. There was about one eighth of a mile of reconstructed road. As I neared the end, *The War Wagon* swerved to the left and almost over the edge. The trailer swerved to the right and then I went into a series of fishtails. Without ever slowing down, I finally got the rig under control again and bounced onto the harder road at the end of the mud. I thought to myself, I don't care if it's a little hard on the four-wheel drive assembly, I'm going to keep the hubs in and drive all the way to the top of the mountain.

After only two switchbacks, I entered a side canyon which allowed the road to more-gradually climb out of the canyon on the north side. I drove until the road again turned to blacktop and stopped to disengage the front hubs. Once out of four-wheel drive, I never looked back but drove to I-80 and back into Sacramento where I immediately crawled into bed. *The War Wagon* had once again done its duty and had returned home to fight another day.