The Orange Jumpsuit

In 1968 the Florida Everglades was experiencing one of its recurring droughts. Water levels were reaching record lows in southern Florida and grass fires were breaking out all over the State. Alligators were grouped around every water hole. Birds were dying by the thousands and plagues of insects blackened the sky.

After calls for assistance from several State and local agencies, the National Oceanic and Atmospheric Administration (NOAA) responded by sending several planes from one of its research branches to South Florida to conduct cloud seeding operations. Commercial cloud seeding companies sometimes claim to be able to increase rain from cumulus clouds without any qualification. However, most commercial cloud seeders will state that they believe they can produce some effect, but the results have not been statistically demonstrated to everyone's satisfaction. Several Federal agencies like NOAA conduct cloud-seeding experiments but seldom claim to be able to put additional rain on the ground. They are sometimes willing to conduct operational cloud seeding in times of drought when directed by the Administration. Even a small possibility of increased precipitation is believed to be worth the effort under emergency situations.

Dr. JoAnne Simpson was the Director of NOAA's Experimental Cloud Physics Branch in the 60s and 70s. She was one of the first women to successfully break into the field of meteorology. Today, Dr. Simpson encourages young women to enter the field by sharing her experiences in talks, interviews, and videos through the auspices of the American Meteorological Society. She completed her Ph.D. at the University of Chicago by writing a dissertation on the entrainment of dry air into cumulus convection. Her research involved a physical simulation of convection by dropping denser, colored fluids into water. For several years she directed field research using multiple aircraft to penetrate maritime cumulus clouds in Florida and measure cloud processes and the formation of precipitation. She also measured the effects of seeding clouds with artificial nucleates like silver iodide and salt particles.

Dr. Simpson set up joint field operations in Miami in 1968 with several other government agencies and flew almost every day that summer to help alleviate the drought. She directed the operation of the NOAA DC-6 research aircraft, the Air Force C-130 cloud physics aircraft, and several smaller planes. The various aircraft typically penetrated a target cloud at several different altitudes from near cloud base to over 20,000 feet. The flight levels and patterns of the planes had to be coordinated with the lead plane by radio through the Federal Aviation Administration (FAA), so they would not interfere with other aircraft operations in the area or collide with one another. Dr. Simpson directed the operations from the DC-6 because it took the greatest number of observations and normally flew at an altitude about half-way up in the cloud giving good visual coverage of the situation.

When government agencies conduct field operations, they frequently invite other agencies to send observers. During my time with the Aerospace Modification Division of the Air Weather Service from 1967 to 1970 I visited several field experiments. One of these conducted by the Air Force Cambridge Research Laboratory (AFCRL) near Boston, Massachusetts and another by the Naval Weapons Center from China Lake, California. Both these visits had interesting experiences associated with them. They are recounted in chapters entitled *The White Sulphur Springs Hotel* and *Look Out Below.* Dr. Simpson invited me to visit her project in Florida as an official representative of the Air Weather Service.

I flew on the Air Force C-130 cloud physics aircraft for one eight-hour flight during the project. When sitting on the runway, the plane leaned to one side, it's right wing much lower than the left. I was told this was because it was one of the oldest C-130s in the Air Force and the right wheel suspension had weakened, causing the plane to list. Dr. Robert Cunningham, director of the AFCRL cloud physics laboratory, affectionally called it *One Wing Low,* his Chinese airplane. Fortunately, this peculiar attitude didn't seem to affect take offs and landings and disappeared once the plane was airborne.

I enjoyed flying on the C-130. It had a jump seat located between the pilot and the copilot from which Robert directed the flights. I was able to stand behind him and observe the clouds through the large windows that surrounded the flight deck.

The C-130 also had an incredible camera system in addition to the standard cloud physics instruments. Mounted on each side of the plane, in the front and back, and in the floor, were large-format cameras used by reconnaissance aircraft. These cameras took pictures on one-hundred-foot rolls of negatives which were one foot wide. The plane typically flew near cloud-top so it had a birds-eye view of the cloud fields as they were penetrated. Sped-up movies of these penetrations shown later were extremely exciting. The plane would fly toward a cloud, penetrate it, and then bank in a 180 or 270 degree turn to re-enter the cloud several times. The camera pointing out the back of the cloud would show vortices behind the plane as it exited the cloud or fly near its top. The C-130 also released dropsondes around the clouds selected for research. A dropsonde is an instrument dropped with a parachute for measuring temperature, humidity, and winds from the cloud to the ground.

I also flew on the NOAA DC-6 on two separate flights. I was seated in the back of the DC-6 next to a turbine which had been installed in the side of the fuselage to generate additional power for all the extra electrical equipment used on the aircraft. In the 1960s much of the test equipment still had vacuum tube technology or large transistors which used large quantities of electrical power. In addition, most of the observations were recorded on strip chart recorders. Each instrument required one or more technicians to calibrate and interpret the information in real time. This contrasts greatly with research aircraft today which require relatively little power and carry one or more computers to record and display up to one hundred observations for a single research meteorologist at the touch of a button.

Consequently, as I looked forward up the aisle of the DC-6, approximately eight instrument consoles were mounted on each side of the plane with at least one technician seated at each console. The heat generated by all the people and equipment kept the air temperature in the plane over ninety degrees. Because of the length of the plane and the whine from the turbine generator near the back of the plane it was impossible to hear any instructions from Dr. Simpson about the plans for investigating the next cloud or what had been learned from the last pass through a cloud. Apparently, few of the technicians needed to pass verbal messages to her, but upon getting ready for a new cloud it was necessary for her to

inform them about several items. I am still puzzled why some type of intercom system with headphones and microphones had not been built into the aircraft. Possibly it was because of the loud whine from the turbine or maybe because there were so many technicians on the plane, but this alternative system was used.

Dr. Simpson, wearing an orange jumpsuit and a brightly-colored bandana to keep her wildly-arranged reddish hair in place, stood at the front of the aircraft between the pilot and co-pilot facing backward down the aisle of the aircraft. She then yelled her instructions into a large bullhorn. Her voice was naturally loud and piercing without the bullhorn and the whine of the turbine. But, amplified through the bullhorn it could peal the paint off the side of the plane. Even from the back of the airplane thirty feet away, the noise was deafening. In addition, feedback through the bullhorn occasionally created a high-pitched squeal sending shock waves down the rows of technicians. I still carry this image in my mind of Dr. Simpson holding a bullhorn and wearing an orange jumpsuit to this day.