



## **Serving on a SAGE Combat Crew**

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From 1949 until 1991, the United States and the Soviet Union were in what was called the Cold War, meaning we never actually attacked one another but we competed against one another for influence on a global scale and each feared a nuclear attack from the other. The attack could come from land-based intercontinental ballistic missiles, sea-based intercontinental ballistic missiles, or from nuclear armed bomber aircraft. Neither nation could do much regarding protecting themselves from missile attacks but defense from incoming bombers was another issue entirely. Each nation had robust air defense systems composed of radar systems and interceptor aircraft. That is where I served while I was on active duty: I was on air defense combat crews in Minnesota and Alaska and our job was to stop any bomber attack against us if it ever came.

For my first combat crew assignment I was stationed with the 23rd Air Division at Duluth AFB, Minnesota, which was part of the Aerospace Defense Command. The nation was divided up into different areas with each different Air Division being responsible for its own area. The 23rd Air Division was responsible for the Great Lakes region which was the industrial heartland of America: Minneapolis, Milwaukee, Chicago, Detroit, and Cleveland. These cities would all be prime targets if we ever came under attack and our job was to defend them.





To do this we had radar sites all over our area that fed their images into the SAGE computer at our Regional Operations Control Center (ROCC) at Duluth AFB. This was America's first large-scale computer, developed in the late 1950s by IBM and the Massachusetts Institute of Technology as "Project Whirlwind." The government spent more on this air defense computer system than it did on the Manhattan Project during World War II.

The computer took up the entire second floor of our rather large building. The computer was so large that it had hallways in it and the people working on the computers would walk down its hallways to get to various areas of it to do maintenance. Most of the technologies used in today's computers, as well as the internet, were first developed in these computers.



**The 23rd Air Division SAGE Building and, right, the AN/FSQ-7 Computer (partial view).**

The fourth floor of the SAGE building was where all of the radar scopes were and there were various rooms where people did different functions with their scopes: Height Finding, Identification, Electronic Warfare, and Weapons. I worked in Weapons, the room where the air battle would be controlled if we were ever attacked. We also controlled daily training missions with our interceptor squadrons from this room.

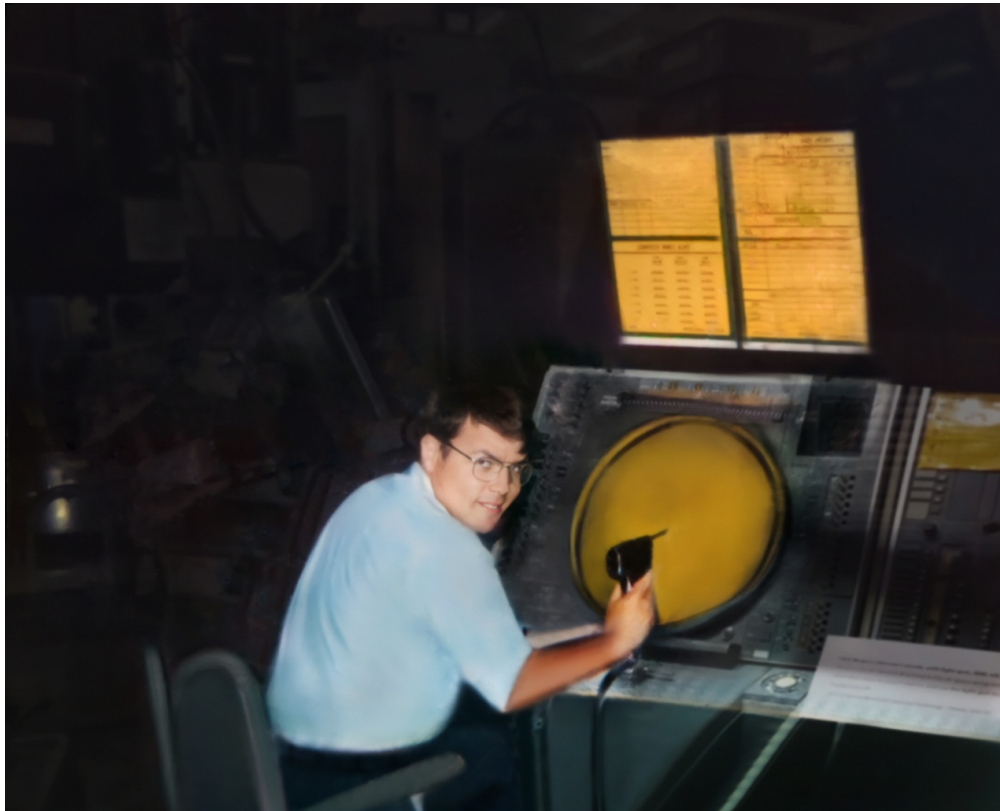


**23rd Air Division SAGE Weapons Room**

The Weapons Room had twenty radar scopes around its perimeter facing outward, divided up into four teams of five radar scopes each. Each team was identified by a number with the team in the right corner as you entered the room being Team 1. Counter clockwise to the various corners of the room we had Team 2, Team 3, and Team 4. Every day we operated using a different team of radar scopes so that each team of scopes got the same amount of wear and

tear on them, plus it wasn't good to let them sit too long without being used. As an aside, our restroom was referred to as Team 5 by the crews.

Associated with each team was one scope that was located inward from them towards the middle of the room, facing towards the center of the room. This was the Weapons Director scope and he supervised his team of five scopes. His scope faced away from the others in order to place the Weapons Director closer to the people that were being supervised. In the very center of the room was a raised dais where the Senior Director had his radar scopes. The Senior Director was responsible for everything that took place in the Weapons room.



**Me at a Weapons Director radar scope.**

Team 2 would protect the western third of our region, Team 3 would protect the central third of our region, Team 4 protected the eastern third of our region, and Team 1 would monitor the entire situation and keep an eye out for safety. To defend our airspace we had three fighter interceptor squadrons in our region. We had the 148th Fighter Interceptor Group in Duluth working to defend the west. They flew the F-101B Voodoo.

The 87th Fighter Interceptor Squadron was located on the Upper Peninsula of Michigan at K.I. Sawyer AFB and they worked to defend the center. They flew the F-106 Delta Dart. And protecting our eastern part of the division was the 127th Fighter Interceptor Group located just north of Detroit at Selfridge ANGB. They also flew the F-106 Delta Dart.



**148th Fighter Interceptor Group F-101B Voodoo, Duluth ANGB, Minnesota.**



**87th Fighter Interceptor Squadron F-106A Delta Dart, K.I. Sawyer AFB, Michigan.**



**127th Fighter Interceptor Group F-106A Delta Dart, Selfridge ANGB, Michigan.**

So what was it like being on an Air Defense Combat Crew?

For one, it was a pretty relaxed job. After all, the Soviet Union was not attacking us eight hours a day. In fact, they never attacked us. We had to be there and ready if they did, but they were pretty much doing the same thing we were doing: waiting and watching.

The apocryphal story was that every day the general in charge of the Soviet bomber forces met with the Soviet premier. The premier would ask the general, "Is today the day we can attack the United States and win?" Every day the general would say, "No Sir, not today." And that's why we were there.

Secondly, it was fun. Every squadron had training flights that they flew every day. The pilots had to keep their skills sharp, as did we, so we had training flights every day. However, if you got to control one flight during a shift you were doing pretty well. We'd generally have four or five flights during the day shift, sometimes more, sometimes less. With only four or five controllers per crew, you usually got one mission a day, but not always. Plus our training section would sometimes take missions for Weapons Controller students to control.

When you did get to control a mission, it was fun. Usually we'd have two or three interceptors at a time and each one would take turns being the target while the other two would practice intercepting him, or we would have one aircraft that would be a target the whole time, usually a T-33 T-Bird, and we'd have two or three interceptors running against him as the T-Bird was the target.



**Michigan Air National Guard T-33 "T-Bird."**

As a controller I would be in charge of the whole show, moving the aircraft around like a giant ballet in the sky as I turned the target on its target run and controlled the interceptors to use various tactics on their attacks. And doing this with a SAGE radar scope was really a high-tech operation for the time. My display was computer generated and the interceptor pilots would slave their aircraft autopilots to follow whatever instructions I put into my computer display.

My inputs into the scope would go to the computer and the computer would broadcast those inputs to the autopilots of the interceptors, and the interceptors would then follow those commands. In essence I would be flying the airplanes using my radar scope while the pilots focused on looking at their onboard radar systems to find their targets and simulate shooting them down.

Very little voice communication was needed. This was to keep the Soviet aircrews from listening in on our broadcasts and figuring out what we were doing, prevented them from hindering our intercepts by using communication jamming techniques, and it made it easier for the controller to handle multiple aircraft.

As an aircraft approached the airspace after taking off from their home base the pilot would check in on my radio frequency and I would give them a briefing regarding what the airspace was that we were operating in and what its bottom and top altitude limits were. Example: "Lima Hotel One Two, Goliath 68, we have Rhinelander Alpha and Bravo Flight Level two nine zero to four zero zero. Radio abort altitude two nine zero."



That last little bit of information told them that if they needed to abort their mission due to radio failure that they were to drop down to the bottom of the airspace and follow standard radio out procedures. Goliath 68 was my callsign.

As they entered the airspace I would tell them to “Squawk four, follow dolly.” “Squawk four” meant that they were to turn on their military transponder that informed radar controllers that they were a military aircraft and “Follow dolly” meant that they were to establish datalink communication between their aircraft’s flight controls and my computer so I could control them from my radar scope. The aircraft would then follow my controls as I would be flying the airplane. Pretty impressive.

Back then, computers were pretty complicated to operate so it took two of us to control airplanes on a mission. It took the controller, who was the one looking at the radar scope and making all the decisions, and the controller technician, an enlisted person who operated the radar scope’s computer panel that was to the right of the screen.



**This is a Weapons Director radar scope (at the Computer History Museum).  
On a Weapons Controller’s scope, the panel to the right was about  
three times larger and required a Controller Technician to operate it.**

An example of what it took to run an intercept: I had to get the target and the interceptor about 25 miles away from one another with the target 5,000 feet higher than the interceptor. I’d turn the target to its target run heading. Assume the interceptor’s callsign was JL03 (Juliet Lima Zero Three). As the target was turning to its final heading I’d say to my Controller Tech, “Juliet Lima Zero Three paired cutoff, angels thirty, Mach point nine three.” I could hear the

clicks of the buttons as they were being pushed and as soon as I heard the Tech say "Set" I would aim my light gun at the target. A circle of light would appear over the computer generated symbology on top of the target's radar blip and I would squeeze the trigger. This light gun action paired with the computer switch actions of my Tech informed the computer that an interceptor was paired against a target and it would start calculating and broadcasting the intercept solution.

Upon squeezing the light gun trigger I would broadcast to the pilot, "Paired cutoff, clear re-attack, post-attack vector two seven zero". This told him that he was committed to an intercept, the tactic used was a cutoff intercept, to follow his datalink instructions, and that after attacking the target from the front it was clear for him to re-attack it from the rear.

After the re-attack he was to turn away from the target flying a heading of 270 degrees. If I had two interceptors going after the same target, usually one about fifteen miles behind the first, I would tell the first one "Paired cutoff, negative reattack, post-attack vector two seven zero", which told him not to re-attack after his first pass but to keep on going on a heading of 270 degrees. This would ensure that the area behind the target was clear when the second interceptor began his re-attack.

When the interceptor pilot saw a target on his radar he'd announce it to me: "Juliet Lima Zero Three, one target two seven zero fifteen" and I would say "Contact, target." As soon as the pilot was sure he had enough information to disregard the datalink information he would say "Judy", which meant that he was taking over the intercept and was responsible for separation of the aircraft. If the pilot did not call "Judy" by a range of six miles then I would call "Min range, re-attack", meaning that he was too close to continue this attack and was to break away from the target and re-attack it from the rear. The pilot would turn left or right to get separation from the target.

As my computer was transmitting target information to the interceptor the pilot would take the bearing to the target as command heading. This had the interceptor constantly heading towards the target as the target continued on its course. This resulted in the interceptor rolling in two to six miles behind the target, perfect position for attacking from the rear. Min range for an attack from the rear was to miles.



**SAGE Weapons Controller using light gun while controlling aircraft.**

If you had three or four airplanes under your control then it could get pretty busy. Between planning each aircraft's vectors to get everybody's training done in an efficient manner, giving directions to the Controller Tech, and talking to the various pilots it could get pretty busy. We had a requirement to do a certain number of intercepts each month using voice control so sometimes we would simply not say "Follow Dolly" and the pilots would be following our voice commands the entire time.

Talking to all of the aircraft while running multiple intercepts while giving direction to the Weapons Tech was really a lot of fun. Throw in the various tactics that were available to us just to mix it up and you were really having a good time.

Sometimes we would have a KC-135 Stratotanker join us and we would do join-ups for aerial refueling, which also had the effect of making our training missions a whole lot longer since our interceptors had gotten refueled. We had a monthly requirement to accomplish a certain number of aerial refueling intercepts, as did our pilots as well.



**Three 87th FIS F-106's doing aerial refueling from a KC-135.**

Sometimes we would be really fortunate and have a B-52 Stratofortress as a dedicated target. This provided excellent training for the B-52's Electronic Warfare Officer to practice jamming our interceptor's radars with his electronic warfare countermeasures equipment plus it gave our pilots experience in an electronic jamming environment.



**California Air National Guard F-106's with a B-52 Stratofortress on a training mission.**

Controlling daily training missions was kind of like playing a video game with the difference being that the blips on your radar scope were real airplanes and the voices you heard were from were real pilots. It was hard to believe that I was being paid to have this much fun.

Occasionally we would have wartime exercises to train us for the actual experience of defending America in the event of an all-out bomber attack against us. These were usually held in the late night hours just after 1:00 am until 4:00 am or so. Outside of our radar coverage the Strategic Air Command would send fleets of B-52 bombers and KC-135 tankers up into northern Canada, turn them into our area of responsibility, and then simulate an attack.

We would have our Weapons Room fully staffed with all four teams, get the three interceptor squadrons up and ready for battle, and then defend America. The attacking force would use electronic jamming in an attempt to make our radars useless as well as communication jamming to confuse the interaction between the controllers and the interceptors.

During one of these wartime exercises I was the Weapons Director in charge of the team defending the central part of our area with F-106s from K.I. Sawyer AFB in the Upper Peninsula. In order to be able to fight for an unlimited amount of time I divided my F-106s into thirds: One third would be either leaving the base for the battle area or returning to the base from the battle area, one third would be in the battle area going against the attacking force, and one third would be on the ground refueling, being rearmed, and being repaired for battle. In this way we had a constant rotation of aircraft to the battle, in the battle, from the battle, and on the ground getting ready to return to battle.

As interceptors entered into battle, I would assign them to their specific targets and inform the controllers who their interceptors were attacking. That alone was pretty exciting for me but while this was all going on a thunderstorm rolled in, passing over K.I. Sawyer and making it very difficult for our aircraft to land and take off.

I found that the ongoing scheduling and communication with the fighter squadron, managing the air battle, and worrying about the weather at their base to be a tad on the stressful side overall. I have no idea how I did overall but nobody complained afterwards and it was reported that we stopped 99% of the attacking aircraft, so that was good.

When we weren't controlling daily training missions or practicing defending America we would be sitting around talking and telling stories, reading, watching television, or studying. Every month we had to take a test of one hundred questions from a list of six hundred questions and you had to score at least 90% on it. The questions had to do with aircraft performance, air to air missile capabilities, control procedures, computer usage, 23rd Air Division resources, and all Air Force regulations dealing with air combat and rules of engagement at the various DEFCON levels. DEFCON Five was a state of peace and there were different levels up to DEFCON One, which was an active attack on the United States.

Since the interceptors we controlled in wartime had air to air missiles with nuclear warheads on them some of our crew members, of which I was one, were on the Nuclear Release Team. This meant that we received training on how to authenticate messages from higher headquarters telling us to have nuclear armed aircraft take off and authenticate again messages telling us that those weapons could be used. Those on the Nuclear Release Team, of which each crew had

at least two on duty at a time, knew one combination to the safe that held the nuclear release codes. The safe had two combinations to it and nobody knew both of them; that's why we had to have at least two team members on duty at all times. Those people that were on this team, in addition to passing their normal monthly tests, had to pass a monthly nuclear release procedures test and pass it with a score of 100%.

Our work schedule was a bit odd. We had a total of three combat crews and each crew would work four days on and four days off. The first two days would be from 8:00 am until 4:00 pm. For the next two days the crew would be divided in half: half the crew would work from 4:00 pm until Midnight and the other half of the crew would work from Midnight until 8:00 am. After those four days were over we would be off for four days. This gave me plenty of time to knock around and enjoy myself.

One thing I found it impossible to do was use my entire 30 days of leave per year that the Air Force allowed. Every time I took four days leave I would have twelve days off from work. For me to use 30 days leave a year would have me practically unemployed. I ended up saving up my unused leave. When I left active duty after four years I took 60 days terminal leave, which meant I was still on active duty for my last sixty days but I could leave my station and was off to start my new life as a seminary student. And after the 60 days leave was used I still had 45 more days of unused leave that I sold back to the Air Force. That was a big help as we were adjusting to a much lower income while I was a full-time student.

So that's what it was like to be on an Air Defense Combat Crew stationed at Duluth AFB. However, it was quite a bit different when I was stationed in Alaska. In Alaska we used a manual radar system, meaning that there was no computerized system to calculate intercepts for us nor did we have datalink control. All controlling was by voice over the radio. Also, in Alaska we actually intercepted Soviet aircraft violating our airspace. This took the experience of being on a Combat Crew to a whole new level which, combined with the extremely isolated living environment, made for a completely different experience. What I experienced in Duluth was almost nothing like what I experienced in Alaska. That story is even more interesting.



**Senior Weapons Controller badge, worn over left pocket of my uniform.**



**Air Force Combat Crew badge, worn over the right pocket of my uniform.**

I can honestly say that serving on an Air Defense Combat Crew was one of the most enjoyable and satisfying things I have ever done in my life.

Gary Odle, March 27, 2021.