Appendix 2

Minuteman IB Broken Arrow

Definition: "Broken Arrow" is a Department of Defense term that refers to an accidental event that involves nuclear weapons, warheads, or components that does not create a risk of nuclear war.[1]

The Accident

On 4 December 1964, the missile combat crew at launch control facility (LCF) L-01, 68 SMS, 44 SMW, Ellsworth Air Force Base, South Dakota, reported a fault in the Inner Zone security system at LF L-02. On 5 December 1964, at 1200 hours Mountain Standard Time (MST), a two-man team from the 44th Missile Inspection and Maintenance Squadron were dispatched to troubleshoot and fix the system.

Permission was granted by the missile combat crew to break the Outer Zone security and the repair team opened the Personnel Access Hatch to check the magnetic switch and to continue the troubleshooting. Subsequent checks eliminated the magnetic switch and the inner zone security drawer on Launcher Equipment Room Level I as defective. This isolated the fault to the Inner Zone Loop. The first item on the Inner Zone Loop checklist was the "K-1" relay located in the security alarm control box. The team used the aural method of checking the relay, listening for a click as the fuse was removed and reinserted. Lacking a fuse puller, one team member used a screwdriver to pry one end of the fuse out of the clip. He did not hear a "click" when it was reinserted and he repeated the procedure and again did not hear a "click" and so repeated the test a third time. At 1500 hours MST, simultaneous with making contact with the fuse, a loud explosion occurred in the launch tube. At the same time, the Missile Status Indicator Launcher Panel in the launch control center indicated a fault and a warhead alarm for LF L-02. The repairmen evacuated to the Launcher Support Building and contacted the missile combat crew which immediately reported the event to the 44 SMW Command Post. At 1529 hours MST the repair team was authorized to reenter the Launcher Equipment Room to reconnoiter. They reported heavy gray smoke in the launch tube. At 1543 hours MST a Potential Broken Arrow was declared and a 2,000 foot cordon was established around LF-02 by the Mobile Strike Team Dispatched from LCF-01.[2]

At 2100 hours, 5 December 1964, Airman 2C Robert Hicks was relaxing in his on-base dorm room when he received a phone call from his team chief , Staff Sergeant Kenneth Renfro. Hicks was a Nuclear Weapon Specialist member of a Minuteman Missile Maintenance Team whose job it was to install/remove guidance control components and re-entry vehicles containing the nuclear warhead. At the time Hicks, was the first Nuclear Weapon Specialist of any missile maintenance team to be awarded a Highly Qualified Rating from the 3901st Strategic Missile Evaluation Squadron which evaluated each missile wing on an annual basis.

Renfro told Hicks to meet his team member Airman 1C Lloyd Howe at the missile wing hangar and pick up a RV/G&C van, which is a specially configured semi-truck used to transport Minuteman reentry vehicles and guidance and control packages to and from the launch facilities. They were to proceed to LF-02, located in Butte County, 2.9 miles east of Vale, South Dakota. Renfro told Hicks that the Mark 11A reentry vehicle was no longer on top of the missile. Renfro would not elaborate further, but Hicks knew the situation was very unusual and that an emergency of significant magnitude existed.[3]

After the RV/G&C van was checked out and road maps were reviewed to determine the correct route to LF-02, the two left the base and headed north. The weather was hovering around 20 degrees Fahrenheit and a recent snowfall was still on the roads, along with ice slush. About halfway between Rapid City and Sturgis, Hicks noticed flashing blue lights in his rearview mirrors. He pulled to the shoulder and walked to the rear of the semi-truck to find a state trooper standing in front of his car. The trooper told Hicks he had noticed smoke coming from the right wheels of the van. Hicks and Howe checked the wheels and found they were hot to the touch. The brake hoses leading from the tractor to the van were checked and found to be leaking air, which controlled the brakes on the van. After the hose connections were removed and reattached, the problem was resolved. The trooper commented that it was late for a trip to the missile field. Hicks told him that they traveled whenever the need dictated. The trooper didn't ask further questions and wished safe travels to the team. It was almost midnight before Hicks and Howe reached LF-02.

Approaching the security gate, they noticed several vehicles not normally found in such a small space. It was obvious that several would have to be moved in order to pull the large tractor trailer into position over the launcher closure door. Once inside and with the RV/G&C van maneuvered into position, Hicks and Howe were briefed by Renfro and told that the work cage would have to be installed so that the missile could be inspected and a team lowered to the bottom of the launch tube to inspect the reentry vehicle. Luckily, while the temperature was hovering around 20 degrees, there was only a slight wind and only trace amounts of snow at the launch facility. The personnel access hatch was already open so there was no time delay in getting the work cage and associated equipment lowered by rope down the access tube to the upper equipment level of the Launcher Equipment Room. Hicks remembers taking a quick look through the autocollimator alignment opening in the side of the launch tube and seeing immediately that the reentry vehicle was no longer in place on the retrorocket spacer. The retrorockets were used to back Stage III away from the reentry vehicle after it was released. Additionally, there was a thin layer of gray dust everywhere, residue from the firing of the retrorockets.

The most urgent task at this point was to get the work cage installed so they could go through the process of safing each of the three stages of the missile, which involved inserting and turning a safety pin at each stage to break the electrical path to the rocket motor igniters. The "diving board," the launch tube access platform which was normally stowed against the side of the launch tube, had to be lowered to provide access into the launch tube and install the work cage. Hicks installed the safety barrier for the platform, with corner poles nearest the missile and with a chain attached to them and the launch tube wall on each side. The work cage is a cage large enough for two people

to stand side-by-side and is attached to a cable that extends from the motor assembly which runs along the circumferential track just below the ceiling of the Launcher Equipment Room. Once in the work cage, traversing around the launch tube and the lowering and raising the cage was done via controls located on the side of the work cage.

As soon as the work cage was installed, they returned to the surface and briefed the on-scene commander that the cage was installed. Renfro called Hicks aside and told him the Explosive Ordnance Disposal (EOD) team that was already on site had not trained on the missile or the work cage. He asked Hicks if he would be willing to accompany an EOD technician and train him on the use of the work cage while Hicks installed the three igniter safety pins to safe the missile. Surprised to hear this, Hicks immediately agreed. The senior EOD team member approached Hicks and said he would be going into the launch tube with him.

Hicks waited until he and the EOD technician had climbed back down the access tube ladder before explaining what the two of them would be doing as they put their safety belts on before climbing into the work cage. Hicks noticed the EOD technician was not comfortable with the work cage as it swung back and forth while he climbed onto it. Hicks recalled a similar feeling the first time he got into the cage during training so he waited until the cage steadied before lowering it a short distance. Seeing that the technician was now more comfortable, Hicks began traversing around the launch tube so that the cage was aligned with the access door on Stage III where the safety pin would be inserted in the motor igniter. The cover had to be opened by removing several screws. Once the door was removed, a safety pin was removed from a bag attached to the work cage along with the safety pin installation device used to insert the square safety pin. The insertion tool had a gun type handle with lights that shined through the access hole to see the receptacle for the pin. Once the pin was installed and turned 90 degrees, the igniter was isolated from stray electrical signals. The pin had a long red lanyard to show the safety pin was in place. Upon completion at Stage III, Hicks lowered the cage down about ten feet, reaching the Stage II safety pin access door and repeated the procedure. As he continued to lower the cage to safe Stage I, Hicks noticed, with relief, two shallow gouges on the surface of Stage II of the missile. He was relieved that the impact of the heavy reentry vehicle on the motor casing had not penetrated to the propellant. They continued to descend to Stage I and repeated the safing procedure one last time.

Hicks continued to lower the cage until they reached the base support ring. The base support ring supports the receiver ring upon which the missile rests and is about 12 feet above the launch tube floor. Hicks recalls seeing the reentry vehicle base windshield on the nearest missile suspension system spring can bracket and wondered just what he was going to see when they got down to the reentry vehicle. The windshield was an aerodynamic fairing which covered the spin rockets used to spin up the reentry vehicle during the reentry process.

He maneuvered the work cage to the space in-between two of the three missile suspension system cables and pushed off the base support ring to allow the work cage to slip past. Hicks recalls thinking it was going to be interesting to maneuver the reentry vehicle past the base support ring. When they got to the bottom of the launch tube they found the reentry vehicle lying horizontally

against the launch tube wall on the floor next to one of the suspension system spring cans (Figure 1). The only missing piece was the windshield, much to the relief of both men. The damage was sufficient to prevent the standard reentry vehicle handling equipment to be used for recovery. After they both had thoroughly examined the damage and ascertained it was safe to move it, the two men, with the EOD technician at the work cage controls to become familiar with them, began the ascent back up the launch tube. Upon reaching the work platform, the two climbed out of the cage, removed their safety belts and climbed back up the ladder of the access tube.

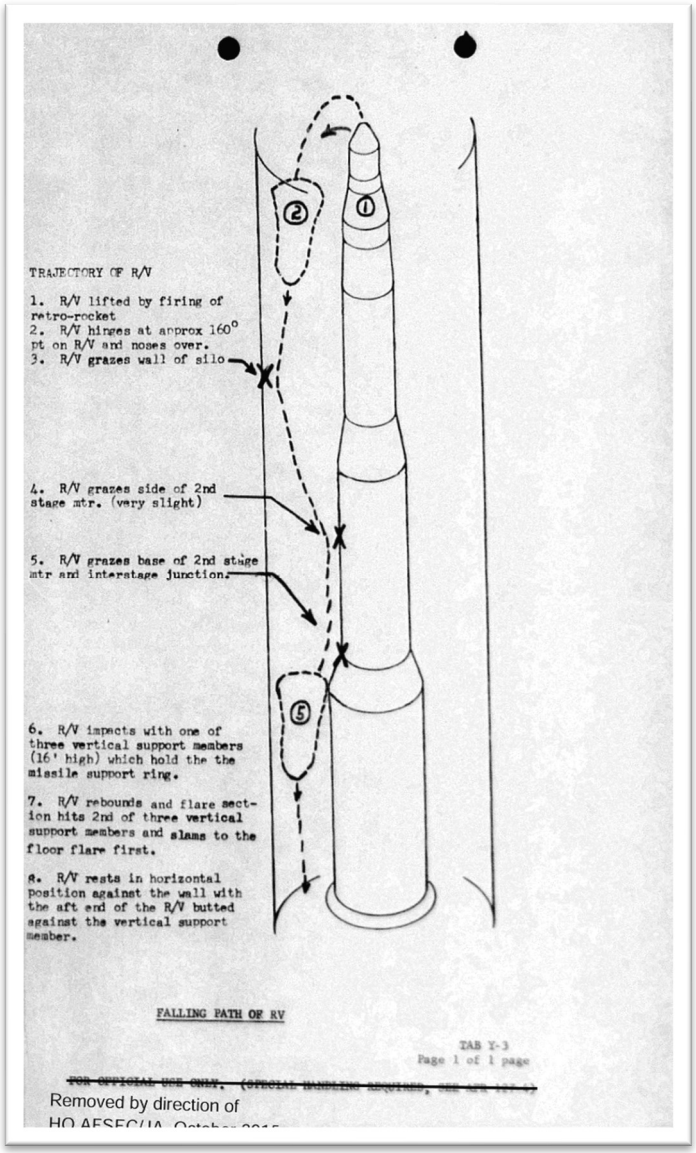

Figure 1. Assumed path of Mark 5 RV. USAF illustration

The on-scene commander was waiting when they reached the surface. The EOD technician gave a detailed summary of the reentry vehicle condition. The on-scene commander immediately asked, "How are we going to get it out?" There was a long silence and Hicks said to the commander, "We take a cargo net that is sufficiently weight-tested and roll it out on the floor of the launch tube. Then we roll the reentry vehicle onto the net and pull it up and out with a crane." The commander was obviously not expecting a response from Hicks and said, "Airman, if I want an opinion from you, I'll ask." Hicks recounted that this was his signal to find a place to get warm!

After a couple of hours of discussions, Renfro approached the truck Hicks was sitting in with Chief Master Sergeant Leopold who was the Maintenance Superintendent of the 43rd Munitions Maintenance Squadron. He was responsible for oversight of all nuclear weapons maintenance in the weapons storage area on Ellsworth AFB. Renfro told Hicks the colonel wanted to hear his idea about using the cargo net. Hicks asked Renfro why he just didn't tell the colonel himself and Renfro said the colonel wanted to hear it from Hicks. Hicks wasn't excited about another discussion with the colonel, but went to further explain his proposed solution for recovery of the reentry vehicle. After this discussion, the colonel, who was connected via a headset to the Headquarters, Strategic Air Command (SAC) at Offutt AFB, Nebraska, returned to his conversation with Headquarters SAC. Hicks went back to the truck and waited for a decision to be made. After another extended period, the colonel gathered the entire group on the site and explained that Headquarters SAC had tentatively approved the use of the cargo net and crane pending the results of a dry run to be accomplished at the training silo approximately 110 miles away using a Mark 11A training reentry vehicle. The decision was made to do the dry run the following day. Hicks and Howe went to LCF-01 to spend the night.

The next morning, at 0900 hours, Hicks and Howe drove to the training site, LF B-07, near Wall, South Dakota. Renfro, the EOD team, the crane and crane operator, the on-scene commander and other team members were already at the site, as was the training Mark 11 reentry vehicle and cargo net. The weather was again in the low 20s without any wind.

Hicks and Howe opened the launcher closure using compressed nitrogen carried in the van to speed up the process. This time two EOD team members went down to the bottom of the launch tube since they were trained in recovering the warhead. The dry run took most of that day. Once the successful result of the dry run was relayed to Headquarters SAC, approval was given for recovery. The team again stayed overnight at LCF L-01.

The recovery of the damaged reentry vehicle was a much slower process due to the time it took to properly position it in the cargo net. It had to be withdrawn in a vertical, nose down position and it had to be repositioned on the cargo net several times to accomplish the proper orientation. Once it was in the desired position, the process of withdrawing it from the launch tube began. One of the complications was that they had to maneuver the work cage as well as the reentry vehicle through the narrow confines between the base support ring and the launch tube wall. With the

reentry vehicle's greatest diameter being 32 inches, it was an inch at a time with instructions of "up very slow," "stop," "up very slow," "stop," repeated over and over to the crane operator as the reentry vehicle was guided past the base support ring. Once the base support ring was cleared, the speed was increased but not much because the team had to maneuver the work cage and guide the reentry vehicle at the same time.

When the reentry vehicle cleared the top of the launch tube and could be swung over to the van, a collective sigh of relief was expressed by the entire team. The damage was then visible and it was extensive. Hicks repositioned the RV/G&C van, which had been moved to permit access for the crane, close to where the reentry vehicle was suspended from the crane cable. Several mattresses were positioned in the center of the van where the team planned to secure the reentry vehicle for transport. The hoist inside the van was positioned at the extreme back of the van, resting on rails that extended outside the back doors as was normal when installing or removing a reentry vehicle. The crane operator then slowly swung the reentry vehicle over to the van hoist such that the hoist could be attached to the cargo net. When the van hoist was secure, tension was applied until the full weight of the reentry vehicle was on the van hoist and relieved from the crane. The crane hook was detached and the reentry vehicle was moved inside the van to the prepared location. Once the correct position was reached, the van hoist was secured in place to prevent movement during transport. Its normal position during transport was completely forward where permanent locks were installed to prevent movement. Heavy duty cable hoist devices called "come-alongs" were used to secure the overhead hoist. The damaged reentry vehicle was then lowered onto the mattresses with just enough weight on the mattresses to prevent side to side movement. Cargo straps were then wrapped around the circumference of the reentry vehicle and attached to the wall attachment points in the van.

The decision was made that the two EOD technicians would ride inside the van during transport. Communication cables were installed between the van interior and the cab of the tractor so the persons riding and monitoring the reentry vehicle could communicate any situation to the driver. Again, it was late in the day, so transporting the reentry vehicle back to Ellsworth AFB was put off until the following day to allow the trip to be completed during daylight hours.

The following morning, 10 December, a convoy of vehicles was formed, including fire trucks, ambulances, security escorts and a variety of other vehicles carrying the other team members and command staff. Renfro told Hicks that he needed to drive the van because the EOD team members were not trained or licensed to drive the vehicle. Hicks already knew this was the case and was prepared to drive back to Ellsworth. Hicks was told to drive around 10-15 miles per hour. Hicks estimated at that speed it would take five to six hours to reach the base. Once the convoy began to move along the road, the EOD team member in the cab of the tractor kept Hicks appraised on how the reentry vehicle was handling the truck movements and all the reports were good with no noticeable movement. Hicks gradually increased the speed while waiting for instructions to reduce the speed back down, but no word came. By the time the convoy reached Interstate 90 at Sturgis, South Dakota, Hicks assumed the speed of approximately 35-40 miles per hour. The trip back to Ellsworth was uneventful with only normal attention as they passed through the populated areas

and traffic. Once the convoy reached the base and the weapons storage area at the extreme rear of the base, the convoy disbanded as the RV/G&C van proceeded through the guarded double gates leading into the weapons storage area. The team proceeded to the Weapons Maintenance Building where the reentry vehicle was off-loaded onto a pallet that had been prepared to secure it.

Aftermath

Robert Hicks was awarded the Air Force Commendation Medal for “acts of courage six December to10 December 1964." The citation was signed by the Secretary the Air Force, Eugene Zuckert, something that did not happen for the other citations Hicks received later in his career.

Endnotes

1. *Weapons Safety Investigations and Reports,* Air Force Manual 91-221, (Headquarters, Air Force Safety Center, Kirtland Air Force Base, New Mexico, 2019), 5. A BROKEN ARROW is the accidental, unauthorized, or unexplained events that could not create the risk of war but meets any of the following criteria: 1) accidental or on authorized launching, firing or use by US forces or US supported Allied forces of a nuclear capable weapon system; 2) an accidental, unauthorized, or unexplained nuclear detonation; 3) non-nuclear detonation (no nuclear yield) or burning of a nuclear weapon or nuclear component; 4) radioactive contamination; 5) public hazard, actual or perceived; 6) jettisoning of a nuclear weapon or nuclear component.

2. "USAF Accident/Incident Report, 5 December 1964," (Headquarters, Air Force Safety Center/CD, Kirtland Air Force Base, New Mexico), 1-65. This is a redacted copy of the full report obtained through a Freedom of Information Act request by the author.

3. Robert Hicks, telephone interview, 28 October 2017