

## TRAINING FOR SHUTTLE BLASTOFF

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*(NOTE: I pitched the idea for a story on the Kennedy Space Center fire service to FIREHOUSE Magazine and it took almost a year to obtain both the official assignment and then the required press credentials. I spent three days at the Kennedy Space Center, escorted by not only KSC Fire Chief Richard Cross and his officers for a unique "insiders view" preceding and including the last successful launch of the Challenger space shuttle on October, 1985. It was the thrill of my lifetime, actually visiting the launch pad, riding in nearby rescue vehicles, and having such "backstage" access for such an experience. The article was actually published two months after the Challenger tragedy in March, 1986.)*

It was less than two hours before the launch of the Space Shuttle Challenger. The huge spacecraft hung like a large ornament on the even larger booster rockets that would carry a crew of eight astronauts - the most ever to be placed into orbit at one time-into a 200-mile-high orbit around the Earth.

The "Close Out" crew had already left the pad and retreated with all other personnel to safe locations more than three miles away. The astronauts, in position aboard the orbiter, sat alone atop thousands of pounds of cryogenics, hypergolic fuels and solid booster propellants, some of which were still being pumped into fuel tanks.

Though everyone had been evacuated from the launch pad area at Florida's Kennedy Space Center (KSC), seven firefighters stood by along with an M113 Armored Personnel Carrier at a point known as A-5, less than a mile away. Dressed in thermal underwear, Nomex and other protective layers, with compressed air supply bottles held in hand and strapped to their legs, the "A-5 Pad Rescue Team" baked in the midday sun of October 25, 1985.

Nearby, at the Shuttle Landing Facility, additional teams of fire personnel, groups of volunteers making up several Off Site Contingency Operations (OSCO) Teams, stood by with their equipment, ready to be airlifted by helicopter to the site of an emergency landing of an aborted mission vehicle. Fire crash trucks and ambulances stood by at various locations, as the countdown to launch continued. Two additional M-113s, fully manned, also stood by to aid in any rescue attempt required at Launch Pad 39A.

This ready posture was started at least six hours before the scheduled noon launch, until four minutes and 23 seconds after Challenger cleared the pad. If, after that time, a problem develops with one of the thousands of systems and the mission is aborted, there can be no return to the Kennedy Space Center for a landing. The orbiter must proceed to another contingency site-Dakar, Senegal in West Africa, for example-where another KSC rescue team, dispatched days earlier from the space center, will be standing by.

On this particular launch, the liftoff came without a hitch or delay, just another routine activity for the members of the Kennedy Space Center Fire and Rescue Service. They had to extinguish only a few small brush fires, remainders of the fiery ignition that had occurred.

Surprisingly, the word "routine" applies to most KSC activities. Shuttle launches, averaging almost one per month, and the related activities throughout the space center have become routine, but the 100 plus members of the fire and rescue service have not become complacent.

The Kennedy Space Center is a sprawling futuristic complex located on the central Atlantic coast of Florida. Covering 140,000 acres and containing a population that varies from 14,000 to 16,000 employees, the complex is like a city in itself. On any launch day, when the population can swell to

40,000 observers and members of the press, 7,000 or more automobiles and 300 busloads of VIPs, the KSC Fire Department's responsibility rivals that of a department in a large U.S. city.

KSC Fire Chief Richard Cross is quick to point out that the majority of the KSC activities can be considered support and standby. Many different types of hazards exist at the center, which include supplies, movements and storage of helium and nitrogen (used for inert purging of lines, pressurization and leak checking during pre-launch operations and onboard propellant tank pressurants); cryogenics like liquid oxygen and liquid hydrogen (used as the primary launch propellants by the orbiter); and the primary hypergolic propellants, fuels and oxidizers that ignite on contact with each other - like monomethylhydrazine and nitrogen tetroxide (used in the orbiter's secondary propulsion systems for orbital maneuvering).

During the various test firings of engines (called "Hotfires"), fueling operations, the incoming and outgoing of special aircraft at the Shuttle Landing Facility and other sensitive activities, KSC fire personnel are called upon to stand by and support procedures with appropriate firefighting and rescue equipment. The scheduling of these standby and support services account for the bulk of KSC fire activities.

The KSC Fire Department is also charged with the protection of all structures within the space center, but, according to Chief Cross, - a 25-year veteran of the Washington, D.C. Fire Department serving his last six years as a battalion chief - the built-in fire suppression systems are extensive. "There are a tremendous amount of built-in detection and suppression systems out here," says the chief. "More than any place I've ever seen. If every city had it, you probably wouldn't need fire departments. There are sprinkler systems, Halon systems, fixed dry powder systems, heat, smoke and gas detectors, low oxygen sensors just everywhere."

Such extensive protection systems, however, prove to be more cost effective at the space center than in many other locations. "We've done an extensive risk analysis for every major facility out here," explains Cross. "One was just done on the Orbiter Processing Facility, basically a hanger-like facility where they work on the orbiters. That one risk analysis report had a dollar-loss figure of \$1 billion. That was for the building and one orbiter. Now that's just for one building."

"What concerns me more from a structural standpoint are buildings like the NASA Headquarters building next door to us here," adds the chief. "I came from Washington, D.C., where I've fought some horrendous fires in offices. Now people think that's no big deal, but they've been some of the worst fires I've pulled up on. In fact, they had one in D.C. last winter that was a hundred million dollars."

Chief Cross also expresses understandable concern in more typical fire protection areas like several trailer complexes on the center and several temporary offices located throughout the complex. He has assigned officers to preplan the buildings from a firefighting standpoint and to develop attack plans.

The KSC Fire and Rescue Service is a division of EG & G Florida, a private contractor. To handle most of the center's base operations, the EG & G work force and subcontractors now number approximately 2000. Formerly fulfilled by 13 separate contractors, the department's responsibilities include activities like designing sophisticated systems for delivering rocket fuels to space vehicles, taking care of roads, grounds, buildings, base security, and, of course, providing fire protection.

The KSC Fire Department consists of 13 officers, 64 firefighters, 20 firefighter/ paramedics and an inspection team of eight fire inspectors, three inspection technicians and a fire marshal. The fire inspectors ensure that all codes are either met or exceeded throughout the complex, especially in connection with so many exotic, explosive and toxic materials.

In addition to three Armored Personnel Carriers, the department's apparatus consists of three 1250-gpm pumpers, each carrying 500 gallons of water; a 1000-gpm pumper; a 95-foot aerial tower, also with a

1000-gpm pump; two older pumpers used as spares and backups, four crash/fire/rescue trucks and two 250-gpm minipumpers.

Certified paramedics along with six mobile intensive care units provide emergency medical services for the base, its employees and visitors, and also provide a sense of security for on-site technicians, engineers and astronauts. Their telemetry communications, a direct by-product of the space program itself, is handled through the KSC Occupational Health Facility. But the Fire and Rescue Service really kicks into high gear before each launch of a space shuttle. Days before the launch, work schedules are altered, off duty personnel are scheduled for launch day activities and preparations, and every contingency operation is reviewed through “walk-throughs,” chalkboard simulations and on-site reviews.

Under the direction of 20-year KSC veteran and Training Officer Captain George Hoggard, who acts as the Pad Rescue Team Leader, six firefighters stand by each mile from the base of Launch Pad 39A. Chief Cross describes the scenario. “About six hours prior to the launch of a space shuttle, we deploy a rescue team at the position called the ‘A-5 roadblock.’ That’s about one mile from the launch pad itself. We go out there six hours before because there are a lot of people out there working. There is a close-out crew on site, and the ice inspection team. As the cryogenics are loaded, they’re super cold, and the condensation and humidity here in Florida cause ice buildup. The crew performs a visual inspection to assure that the buildup is not excessive. We’re out there in case there is a propellant leak. Should they be exposed to a toxic substance or become incapacitated, we can effect a rescue.”

Cross says that when the ice inspection team leaves, firefighters and apparatus at the pad gate “fall back” and leave the close-out crew to await the astronauts’ arrival. Once the astronauts have been positioned inside the orbiter, the close-out crew closes the hatch, seals the orbiter and leaves the structure. The A-5 team becomes the closest help available during the last one-and-a-half to two hours of the countdown.

“If something happens out there [on the launch pad] that incapacitates the flight crew or remaining close-out crew so they cannot function on their own to escape the structure, then we are called to go in,” explains Cross. “The rescue crew responds to the pad in the M-113 (Armored Personnel Carrier), which can go about 40 mph. The members get on the elevator and ride to the 195-foot level, where they can access the orbiter hatch where the crew enters. Drawing from a rescue locker nearby, they pull out a hatch tool and rescue chair and proceed through the ‘White Room.’ Two members of the rescue crew then enter the orbiter and go directly to the flight deck.” Using a metal sliding board that fits from the hatch opening down to the edge of the pilot’s seat, the rescuers unhook the straps that restrain the astronauts and physically slide the pilot and other crew members up and out of the orbiter. They place the astronauts into a rescue chair, take them to the opposite side of the structure and put them into a large rescue “basket” that holds up to five people. A device called a “Guillotine Cutter” is used to cut the restraining rope holding the basket in place. The basket slides down a metal wire cable to ground level at a distance of a quarter-mile away from the pad. There are five such baskets available for use, and each is caught just above ground level by large webbing or nets. The victims can then be transferred to a nearby “Slidewire Bunker” or be placed into other M-113s that respond to the base of the slidewire.

Each astronaut receives training by KSC fire personnel in the operation of the M-113s, in case they must use the escape method on their own. In any case, the last basket is reserved for rescue personnel.

“Actually, we’re only involved if the astronauts are unable to help themselves. They know the procedures, and if they have to move out, they will,” says the chief.

If all goes well and the launch is successful, fire teams then respond to the pad area to extinguish any small brush or grass fires that may have resulted. These are minor, says Cross, but since they can occur near some of the fueling lines and tanks, they need to be taken care of.

“Then the pad has to be ‘safed,’ “ continues the chief. Environmental Health teams will eventually go directly to the pad and check for broken fuel or gas lines using mechanical “sniffers.” Adds Cross: “We back up these crews, who also walk the structure, checking for damage.

“Should there be a problem after the launch, however-for example, if they weren’t getting full power from the engines, and a ‘Return To Launch Site’ (RTL) is declared, then the OSCO Team goes into action.”

OSCO is made up of teams of KSC Fire and Rescue Service volunteers, including two women. Their skills come into play in the event of a declared RTL within four minutes and 23 seconds. (After that time, speed and distance dictate that another predetermined contingency landing site must be used.) If the orbiter must return to KSC, rescue teams have 22 minutes to wait. It takes that long for the shuttle to jettison its boosters and make a wide circle in order to reduce air speed from nearly 16,000 mph to approximately 220 mph for a landing attempt at the Shuttle Landing Facility. “If all goes well, the shuttle should be able to effect a landing at the airstrip,” explains Cross. “Should the shuttle overshoot or undershoot the landing strip, it can come down anywhere in the Atlantic, in the waterways or along the coast of Florida.”

The chief explains that the craft may come down either right or left of the runway as well. “Since last winter, there haven’t been any scheduled landings at the KSC landing facility,” says Cross. “Since the pilot must steer the craft with his brakes, we’ve had a couple of tires blow on landing. Recently a steering capability was developed, and in all probability the landings will resume here at KSC about the beginning of the year.”

During those 22 minutes, a helicopter will act as a spotter. Once it determines a location for the downed craft, additional choppers airlift the OSCO teams along with their equipment to the site. If the craft lands in water, the teams are dropped into the water a safe distance from the orbiter to avoid any possible ignition of escaping vapors. The OSCO teams paddle to the orbiter and, with teams on both sides of the cockpit area, throw a messenger line over the top of the craft. Using this line, rescuers hoist a Jacobs Ladder so they can reach the hatch and gain entry. During this time the teams communicate with each other with CO2 airhorns, as radios are difficult to use in water. The rescuers remove the crew members, place them in Stokes baskets and then paddle away so they can be retrieved by the helicopters.

If the craft ends up on land, the teams are transported by chopper to the site and left nearby. Each chopper carries the complete rescue pack and equipment for each team. The first pack consists of two Stokes baskets, a life raft and oars, a Jacobs Ladder and messenger line, hatch tools, high-intensity chemical lights, additional air bottles, CO2 air horns and radio vectors that send out a continuing signal for other teams to home in on.

Though NASA officials contend that the orbiter should float in water, OSCO teams train with the belief that the orbiter may sink very rapidly or, at the very least, nose up, depending on the payload, the depth of the water and other factors. In either case, training is based on the worst case scenario.

Under the direction of OSCO Rescue Chief Barry Davidson, the teams practice, check out and pack the various rescue packs they will take with them to the site. Under the shadow of the Mate/DeMate Device, used to place or remove the orbiter from the Boeing 747 used for shuttle transport, the OSCO teams inspect and pack all equipment.

In addition to carrying rescue packs, the choppers can also transport ladders, hose-lines, floating portable 250-gpm pumps and other equipment in a separate pack that can be slung underneath the helicopter. The portable water tank can be filled by the choppers using tanks ferried from a water site to the orbiter site in forest firefighting fashion, suspended under the helicopter.

Prior to each launch, the OSCO teams and other KSC firefighters brush up on procedures to be followed using a mockup shuttle cockpit located near the press site complex. The mock-up can either be laid on its belly, to simulate a ground landing, or tipped vertically, to resemble its posture on the launch pad itself. Or the entire structure can be placed in an adjacent waterway, so crews can practice water rescues with all the necessary equipment.

For almost every launch so far, Chief Cross adds, an additional OSCO team is dispatched to the contingency landing” site in Dakar, Senegal, in West Africa. “It’s right on the beach, and the guys say it’s pretty nice. They like to go there.” says the chief. “But this time it’s not there. Since Spacelab flights are placed into a different orbit than usual, the contingency site is in Spain. There, a U.S. Air Force Base handles any emergency landings.” Beginning in September of this year, when some of the launches will originate from Vandenberg Air Force Base, the alternate landing sites will be on either Easter Island or Hau, near Tahiti in the South Pacific.

Training isn’t restricted to rescue operations, however. Elsewhere on the base is a special fire training site that includes a mock-up aircraft fuselage, for aircraft fire fighting training, and a fuel-burning pit, for crews to practice containment and extinguishment of fuel fires. One pit, specially constructed for the out-of-the ordinary fuels used at KSC, is situated in the midst of protective bunkers. Hypergolic fuels are introduced into the pit from opposite sides. As they meet they ignite, resulting in a series of rapid explosions that allow the orbiter to maneuver while in space.

The members of the Kennedy Space Center Fire and Rescue Service are proud of the part they play in the space program. The hours are long and training must sometimes be done before or after shifts, due to the heavy and continuous schedule. According to the chief, overtime must be used to provide adequate protection and service at times. A single launch, for example, can cost \$1500 in overtime alone, since the shift complement must at times be doubled. Once, when various conditions required a hold of three continuous days, and ready postures had to be maintained, the overtime cost came to nearly \$25,000.

Whether the responsibilities of fire and rescue services are as routine as inspections and standby or as critical as the rescue of astronauts, the men and women of the Kennedy Space Center Fire and Rescue Service are well aware of the special part they play both in the fire service and in mankind’s ever-increasing expansion into the last real frontier.

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