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SPACE MEDICINE ASSOCIATION NEWS

Medical Operations at Kennedy Space Center

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In order to better understand the many functions and duties required of medical operations at the Kennedy Space Center (KSC), a brief description is helpful. The Kennedy Space Center is very much like a small city. It requires food, water, sanitation, police, fire & rescue, and medical services. The location is in a wildlife preserve, which includes 160,000 acres of estuary swampland and, of course, some of the finest specimens of alligators and snakes you would ever care to meet. A broad range of industrial processes are performed in complexes that sprawl across the large landscape. A visitor's center also accommodates several thousand tourists a day. In addition, we have the responsibility for the nominal Shuttle operational support including microbiological and potable water monitoring, pre-launch physical exam support, and postflight data collection.

KSC Medical Support

Medical services including emergency care, medical evacuation, evaluation/ treatment of occupational injuries and exposures, physical therapy, ergonomic evaluations, indoor air quality evaluations, mental health and employee assistance counseling are provided to the 16,000 employees. This not only includes injuries and exposures arising from the processing and launching of space vehicles, but also those resulting from the many different industrial and office working environments. Most of these employees require medical certifications to perform their jobs. This is accomplished through periodic physical examination at the Occupational Health Facility. First aid, emergency triage, and medevac capabilities are available to the tourists at the visitor's center, as well. People sometimes ask, "What kinds of medical events do you see?" I would have to say that in my 20 years of experience it pretty well runs the entire gamut of the things that you might encounter in the emergency room (except, of course, without the violent crime

and drugs) but spiced up with rocket fuel (hydrazine) and oxidizer (nitrogen tetroxide) exposures. Due to the occupational setting, the extremes of age are also less common, although a day care center and the tourists will keep you on your toes with the occasional Pediatric and Geriatric consults.

KSC Shuttle Launch and Landing Support

"Make a Plan and Practice it" is a good motto for any type of disaster preparation program. The KSC Emergency Medical Services Plan provides a dynamic guideline to follow during a contingency. Through regular rehearsal and simulation, improvements are constantly incorporated.

For a launch or landing, we bring in extra support: 4 trauma physicians from the University of Florida, 4 USAF Blackhawk helicopters with 4 DOD Flight Surgeons and 4-8 Para-rescue Specialists. At least 4 area hospitals (including 2-3 medevac helicopter services) are placed on alert. These augment a baseline of triage, command post, and clinic personnel including physicians, nurses, logistics (supplies) coordinators, communications specialists, laboratory personnel, and X-ray technicians. We also have 3-4 ambulances with 6-8 trained paramedics, 7-14 Fire/Rescue personnel and 1-2 NASA medevac UH-1 helicopters. Three Environmental Health Specialists are present to detect possible hazardous chemical contamination.

The overall command and control is by a physician (EMS) stationed in the Launch Control Center who is linked by radio, video (secure internet), and wireless communication to the Triage forces. An additional KSC physician coordinates with the outside hospitals. The Johnson Space Center Crew Surgeon is with the Triage forces in the field, while the Deputy Crew Surgeon is stationed with the EMS physician in the Launch Control Center (Fig. 1). Medical support is divided into Triage & medevac for Shuttle contingencies, and support for other operations and guests/tourists. The plan consists of the Triage forces staging near the Launch Area Clinic (launch) or near the Shuttle Landing Facility (landing). Helicopters (rescue/medevac) will stage at the Shuttle Landing Facility. The other medical teams are distributed to viewing sites and industrial areas (work on many projects continues throughout the Shuttle launch and landing so a wide variety of injuries/illnesses that are not directly related to the Shuttle event must be prepared to be treated).

Shuttle contingencies are categorized as Modes. Modes I-IV are pre-launch: Mode I involves the Shuttle Crew only and they are able to egress on their own; Mode II involves both the Shuttle Crew and the Closeout Crew (the team which helps the Shuttle Crew in the final launch preparations) and they are able to egress on own; Mode III con-

cerns the Shuttle Crew only and rescue is required; Mode IV means Shuttle Crew and Closeout Crew both require rescue (Fig. 2) Modes V-VI apply only to landing: in Mode V the Shuttle Crew is able to egress on their own; in Mode VI the Shuttle Crew require rescue. Mode VII is a landing or impact outside of the nominal runway area, but within KSC. Mode VIII is a bailout (expected to be over water) or mishap outside of KSC. In Modes VII & VIII the Shuttle Crew may be taken directly by the USAF helicopters and rescue teams to area hospitals or to a triage site at KSC. In Modes I-VI the Crew will be rescued by KSC Fire/Rescue personnel and taken to a triage site in M113 armored personnel carriers (pre-launch) or by Bearcat (amphibious) or by other rescue vehicles (landing).

Once at the Triage site, the Shuttle Crew and any other personnel who are potentially injured or exposed are evaluated by an Advance Paramedic for the fundamental ABCs (Airway, Breathing, Circulation) while an Environmental Health Specialist checks for Hydrazine (rocket fuel), Nitrogen Tetroxide (rocket oxidizer), or other contaminants in the Decontamination Area. ABC fundamental interventions may be accomplished here if required. The patients are then transferred across the "clean line" to the Treatment area for further evaluation and stabilization by the Triage and Trauma Physicians. The Triage Physician will then consult with the EMS Physician to arrange for appropriate medical evacuation. Those crewmembers who are not injured will meet with the Crew Surgeon at the Triage site to assist with further coordination of any injured crewmembers.

This elaborate and complicated plan benefits from periodic rehearsal simulations. We currently accomplish this following the nominal landing support of each Shuttle mission. It is convenient since the various forces are already in place. It can be tough because while the rest of the Space Center is celebrating a successful mission, your work is only just beginning. Such is the life of a physician at KSC. You've got to love it!



Fig1. LAUNCH CONTROL CENTER--The EMS and the Console Biomedical Systems Engineer stationed at the biomed console in Firing Room 3 at KSC.



Fig 2. A MODE IV SIMULATION--Mode IV involves paramedics, nurses, emergency physicians and a simulated Shuttle crewmember.