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Development of an Audio Visual Tool for Medical Training at Kennedy Space Center

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Development of an Audio-Visual Tool for Medical Training at Kennedy Space Center

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science

By

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY Nidal El Rimawi ENTITLED Development of an Audio-Visual Tool for Medical Training at Kennedy Space Center BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF Master of Science.

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ABSTRACT

El Rimawi, Nidal. M.D. M.S., Department of Aerospace Medicine, Wright State University, 2006. Development of an Audio-Visual Tool for Medical Training at Kennedy Space Center

As part of an effort to improve efficiency of space-flight medical support at Kennedy Space Center, a training video was created to replace a series of lectures given before a launch or landing of the Space Shuttle. The video was designed to familiarize volunteer physicians from around the country with the specific emergency response protocols for a Space Shuttle launch or landing emergency at Kennedy Space Center.

The methods used were consistent with standard film making techniques as outlined in several film making texts. The Production was divided into three phases; A pre-production phase wherein the research, screenwriting and production planning took place, a Production phase consisting of the actual filming of the various scenes in the script and finally, a post-production phase during which the video was edited, music was added and the finished video screened and copied.

The result was that the video was completed in seven months with the participation of over a hundred people. The final video won several awards for educational and government film and met all expectations of the author and the medical department. It was ultimately given to the Aerospace Medicine Residency program at Wright State University and to the medical staff at Kennedy Space Center.

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BACKGROUND

After the 1986 Challenger disaster authorities at Kennedy Space Center (KSC) made a strong emphasis on emergency response to a Space Shuttle mishap. Planning committees divided most foreseeable emergencies into four launch emergency scenarios (modes I through IV), three landing emergency scenarios (Modes V through VII) and a special mode, (Mode VIII), during which the orbiter has to ditch at sea far from Kennedy Space Center (KSC). Medical teams would be selected and trained to respond in each of these modes.

Medical Operations at Kennedy Space Center involve a team of doctors and nurses dedicated to medical rescue operations and life sciences headquartered at the Operations and Checkout Building and a team of doctors and nurses dedicated to employee health centered at the Occupational Health Facility (OHF). During a shuttle mission, volunteer physicians from all over Florida and Military Flight surgeons from across the nation are called upon to join the medical teams already at Kennedy Space Center. The volunteer physicians are emergency medicine specialists, general surgeons and orthopedic surgeons selected from several hospitals to which injured astronauts or ground crew personnel would be taken in case of an emergency.

During a launch or landing emergency these doctors would triage the patients, treat them in accordance with Advanced Trauma Life Support (ATLS) standards and prepare them for transport in conjunction with the fire rescue crews already in place at KSC. Since the volunteer medical teams are already experts in their own fields of medicine, the only

procedures they needed to be briefed on were those special procedures undertaken at Kennedy Space Center.

One of the pre-mission tasks for the KSC medical team was to brief these volunteer doctors on the overall emergency medical system plan (EMS Plan) as well as to familiarize them with the people, jargon, locations and special equipment peculiar to KSC rescue operations. These briefings would take place at Patrick AFB and at KSC.

As one of the staff members to give these briefings on a regular basis, it became obvious to this author that the repetitive nature of the task lent itself well to a standard presentation or even a video. This video could be sent out in advance and thereby facilitate the integration of the volunteer medical teams. The video could also be reviewed on the day of operations and important points discussed.

OBJECTIVE

The general understanding before this video was undertaken, was that the volunteer physicians would be more likely to pay close attention to a comprehensive video than to read through the written EMS manual. The seven month project to produce this video forms the basis of this thesis.

Therefore, the main objective was to produce an educational, entertaining training video using standard film making techniques. In so doing, the finished video would be more appealing to viewers than reading the manual or attending lectures.

METHODS

Pre-production:

Gregory Goodell, screenwriting teacher, defines this phase as the phase involving "the assembly of all elements necessary to begin principal photography" (Goodell, p. 75).

For this project, this involved research on the topic, writing the script, creating a budget, negotiating the finances, assembling the equipment and crew, rehearsing, location scouting and obtaining necessary clearances.

In early planning of this project, the author was selected to write and direct the video due to his interest in and background in film. The author took several film courses in college and worked previously as an assistant on several documentaries for the National Film Board of Canada.

Research on the topic:

Research for the script began in June of 2000. This consisted of becoming thoroughly familiar with the KSC emergency medical response plan by reading each section carefully and discussing it with the authors of the plan. This document contains detailed protocols for all medical operations at Kennedy Space Center. Essentially the EMS plan

is the same each time with a new revision produced before each mission to update the names and contact data of personnel and any special information on that particular mission. A copy may be requested from NASA through the Freedom of Information act.

We also began reviewing communications protocols and rescue procedures on KSC by interviewing Capt. George Hoggard, Deputy Commander of the fire rescue service and a few of the firefighters at KSC. We also became familiar with the rescue hardware available at KSC by visiting the various areas where these marvels of engineering were kept and maintained. Once a thorough understanding of all the players, procedures and equipment mentioned in the EMS plan was achieved, we were ready to write the initial script.

Creating a Budget:

The budget for the video was drafted using “Easy Budget for feature Films” software, purchased from The Easy Budget Company (800)356-7461, http://www.easy-budget.com. The total production budget was $107,000 (actual budget documents were not available to be appended here).

Len Erikson, VP of Bionetics Photo Services (BPS) and production manager on this project, explained that the general “rule of thumb” for a documentary film one can estimate a budget at approximately $2,000 to $5,000 per minute. For a 40-minute script, $107,000 was at the lower end of this estimate.

In general, film budgets can be broken down as follows: 5% of the gross budget for the story and screenplay, 5% for the producer and director together, 20% for the cast, 20% for studio overhead, 35% for crew, sets, costumes and equipment, 5% for taxes and 10% for contingencies (Goodell p.112).

Assembling the crew and equipment:

The Producing Unit: The Creative Producers are those involved in every aspect of making the film. They are the ones who hire personnel and serve as the interface between all the various groups working on the film. Goodell describes them as the first ones on the project and last ones off (Goodell p. 155). In our case, we had three producers working together, Doug Grover, John Martin and Nidal El Rimawi. They collaborated on the selection of the entire crew and all production issues, such as casting, editing, cinematography, sound and other technical issues.

Len Erickson, vice president of BPS studios, served as the Unit Production Manager. This is the person responsible for the logistics of the production through the completion of principal photography, the actual filming of the shots for the film. Mr. Erikson, with over 20 years in the film business, was highly experienced in commercial logistics as well as the logistics of film production. The Unit Production Manager also plays an integral role in ensuring the production adheres to the budget.

The Production Coordinator was Linda Perry. The production coordinator is someone who coordinates the logistics of the production such as shipping and receiving film and equipment, arranging transportation and accommodations and attending to any other special needs such as finding a dentist for crewmembers (Goodell p. 157). Ms. Perry was the natural choice for this position since it highly overlapped with her duties as executive assistant to the studio president.

Production Assistants (general assistants) were recruited from among the staff of the KSC Fitness Center. Ms. Starley Gensman, director of the fitness center, was a big help in recruiting production assistants. The production assistants are general helpers in day to day operations of the cast and crew. Grips are a sub-class of production assistants and are selected for physically demanding tasks. Since several of the staff in the fitness center were personal trainers they were excellent for these jobs.

Ms. Gensman also served as Script Supervisor. The script supervisor assists the director in ensuring that what is being filmed follows the script. She was selected due to her past experience making short films with the author and her attention to detail.

The Photographic Unit: The Director of Photography (DP) was John Martin, former commander of a United States Air Force Combat Photography Squadron. The DP directs the cinematographers in the use of particular lenses, lighting equipment and camera movements. The D.P. works with the director to decide on camera movement and placement. The Cinematographers were John Martin, Doug Grover and Chris Zettler.

Still photographer Adam Nehr, Photography Hall of Fame honoree, was the Production Photographer. The production stills are also useful in capturing exactly how a set looked as it was filmed should the need arise to re-film a particular shot. They are a photographic record of what was being done on the production.

Production Sound: Mr. Doug Grover, former Sound Engineer for Gloria Estefan and Santana, was the Production Sound Mixer. He reviewed all sound tracks for the production. He monitored sound from microphones and modified sound recordings for clarity or to bring out certain elements of the sound. He also modified the musical score to fit the length and action in any given scene. He supervised the use of sound effects and worked with the Director, Dr. Rimawi, to select music and sound effects needed for each scene.

Technical Units: Mr. Chris Zettler was selected as the Gaffer. The Gaffer is the set electrician. The gaffer designs and implements all electrical riggings and lights. They also ensure that cameras have batteries, lights are wired correctly and microphones are wired and out of view. Mr. Zettler performs all these functions at BPS on a regular basis and he continued in that capacity on this particular project.

John Martin filled the position of Transportation Captain. The transportation captain ensures that vehicles are fuelled, outfitted with needed equipment, loaded with everything for the next day's shoot and that the vehicles are in good order.

Equipment List:

Cameras: The production cameras used for principal photography were Panasonic DVC (digital video cameras) models AJ-D700. Still photography was achieved with two 35-mm Nikon F3HP SLR cameras and one Pentax 67II medium format camera.

Monitors: Production video monitors were Sony PVM-14L 5/1 video monitors.

Sound recording: Microphones used included mini-boom microphones, which came with the Panasonic cameras and Sony WCS 999 wireless microphones from Radio Shack. The narration "voice-overs" were recorded in a sound booth built in-house by Bionetics engineers and wired through the twin Tascam CD RW 4U CD recording decks.

Sound mixing: Sound refinements were made using Sony Soundforge 6.0 software. The mixer used in the studio was the Yamaha MG166FX 16-Channel, 4-Bus Mixer with Dual EFX.

Soundtrack: The music used for the soundtrack was the "615 music library", Gold series, purchased from 615 Music; 1030 16th Avenue South, Nashville, TN 37212, (615) 244-6515. Sound effects were acquired from a sound effects library purchased from Valentino Production Music, Inc. 500 Executive Blvd., Elmsford, NY 10523-0534 Phone: (800) 223-6278.

Video recording media: Video was captured on Sony DVM 60 PR2 Video Cartridges. Playback was on two Sony DSR 25 DVC cam digital video recorders.

Editing: Non-linear editing (done on computers rather than cutting actual film) was performed using two customized studio computers running DPS Velocity V3D 5530 film editing software and the corresponding hardware card. This was purchased from 5401 S. Kirkman Rd, Orlando, FL 32819 Phone: (407) 926-0277. Digital video was downloaded onto computers with hard drives having a capacity of 320 Gigabytes.

Vehicles: The cars used for this production included four Ford Large capacity cargo vans, a Volkswagen Jetta and a Pontiac Grand Am.

Miscellaneous Equipment: Light meters, clap boards, reflectors, microphone booms and sound meters, were donated courtesy of Universal Studios, Orlando, FL.

Specialized equipment: We had access to and used two NASA 177 ft Bronto sky lift vehicles, two NASA armored personnel carriers (M-113), two NASA twin Huey helicopters, one NASA 15 foot security patrol boat, one NASA Bear Cat tracked rescue vehicle, two NASA 4 Wheel All Terrain vehicles and the NASA crew transport vehicle (Airport Camel Lift bus).

Rehearsing:

The documentary format requires a sense of realism. This is why the principal speakers in the video were the actual staff members involved in the rescue operations at Kennedy Space Center. Rehearsals were kept to a minimum in hopes of not making the lines sound too mechanical. When they did occur, rehearsals consisted of one-on-one readings between Dr. Rimawi and the speaker rather than set rehearsals in front of the whole crew and other speakers. Rehearsal of camera placement and movement was performed on the day of a planned shoot several hours before the scheduled shoot. Stunt rehearsals were also performed on the morning of the planned shoot to take weather conditions into account.

Location Scouting:

Location Scouting was conducted two weeks prior to commencement of principal photography. Scouting was conducted Dr. Rimawi and the cinematographers. Production vans were used as well as all terrain vehicles when necessary. Still photography and topographic maps were used to designate potential filming locations. Permits were obtained from the Brevard County Film Commission for filming in public locations. Permission was obtained from NASA security to film in restricted areas of the space center.

Obtaining Necessary Clearances:

Getting around Kennedy Space Center is tricky due to very tight security. All personnel on the base wear badges that have a list of areas they are authorized to enter. Trying to

get in and out of sensitive operational areas with four vans full of equipment and a film crew every day required many phone calls and very delicate negotiation. The necessary clearances were obtained by The author through the NASA Security Department, NASA Department of Grounds, Kennedy Space Center Flight Director and Kennedy Space Center Public Affairs Office.

Production:

The first step in production was the creation of a production schedule that detailed the timeline for planning, principal photography, contingencies and post-production.

Members of the crew needed for the day's filming met at the Operations and Checkout Building at 8:00 am daily for a briefing and any rehearsals. Approximately six to eight hours of filming was achieved each day. The scenes were assembled from shots filmed at multiple locations around KSC. Historic footage was copied from NASA film archive tapes, digitized and then incorporated in the video.

Principal Photography:

Director David Mamet has said that principal photography is simply filming the shots in the shot list (Mamet p.5).

The script was broken down into scenes and each scene was broken down into a list of all the individual shots needed to film each element in the scene. These individual shots are essentially tiles that are placed end to end to create a mosaic which is the coherent film.

The shots can be divided into the following general categories: aerial cinematography, location shots and archived film. The shot list consisted of 120 shots. The order in which the shots were filmed was based on weather, availability of speakers, and availability of special equipment, space shuttle launch schedule and timing of special clearance permits.

Principal photography began on October 8, 2000 and ended on November 17 of the same year. A total of 20 hours of video was captured on tape. This is a shooting ratio of 30:1 (total time: film time), which is acceptable for video since the cost of tape is so cheap compared to film.

The aerial cinematography was filmed from a NASA twin Huey helicopter or from a NASA “Bronto” High Lift vehicle with its basket platform lifted to a height of 160 feet. The high lift vehicle is a giant version of the platform trucks the telephone company uses to repair phone lines.

Location shots were filmed at the following sites:

- Beach Access Road on the perimeter of KSC
- Astronaut Escape Bunker at the base of launch pad 39B
- NASA Parkway West (Highway 405)
- Crawler Way between Mission Control Center and launch pad 39B
- Western Gate to KSC and Gate House
- Interior marshland near Happy Creek

- Merritt Island National Wildlife Refuge
- Orlando Regional Medical Center
- SHANDS Hospital in Gainesville
- Holmes Hospital in Melbourne
- Halifax Hospital in Daytona Beach
- Parrish Medical Center in Titusville
- Florida Hospital in Orlando
- Launch pad 39A
- Launch pad 39B
- Launch Control Center
- Operations and Checkout Building
- Occupational Health Facility
- Biomedical Data Collection Facility
- Crew transport vehicle
- Shuttle Landing Facility
- Cape Canaveral Space Museum
- Vehicle Assembly Building
- Patrick Air Force Base
- Indian River Lagoon
- Banana Creek

The production phase ended when all shots on the shot list were filmed successfully. Each shot was reviewed by the director and editor to make sure that lighting, sound and action elements were correct and fit well with the shots coming before and after.

Extra shots that were not planned for were kept in case there was a gap in any shots needed to complete a scene.

The Director and Editor prepared the studio, computers and mixing equipment for the next major phase, Post-Production.

Post Production:

Post-Production is the stage that includes picture editing, dialogue editing, sound effects editing, music scoring, music editing, the sound mix, titles and optical effects and printing of the assembled film (Ascher p.2).

Post-production work began in early November. Studio computers were reconfigured to accommodate the massive amounts of digital data. The film now appeared as six linear bands on three monitors in the studio (2 video bands and 4 sound bands). Each band is a timeline onto which a shot or a sound is "dragged and dropped" from wherever these files are stored. Each shot is then electronically trimmed to fit tightly against the shot before it. The corresponding sound tracks are trimmed to match the length of the shots.

A music library was purchased (see equipment list above). Upon receipt of the music library the director and the film editor selected several pieces of music that matched the mood of each shot and these were labeled and saved onto the hard drive. Later one piece of music was selected as the overall musical score for the entire scene.

Similarly a sound effects library was purchased and surveyed for appropriate sounds. Each shot was enhanced by either clipping pieces of natural sound recorded at the time of filming or by selecting a sound effect to augment the overall effect of the visual shot. Music and sound effects were placed on separate timelines in the editing system to better distinguish them.

Voice recording began on the narration and off screen commentary using the Bionetics sound booth. John Martin read the narration under the direction of The author. All together there were four tracks of audio: speech, sound effects, music and previously recorded sound tracks from archived film. Sound mixing and editing was done by Doug Grover using digital sound editing software and skill gained from years of music industry production. Total time for Post-production was approximately 400 hrs.

RESULTS

This section was not intended to stand alone. To describe every shot discussed below would be extremely cumbersome, requiring the proverbial thousand words for each picture. This section was intended to be read while watching the completed video and / or referring to the final script. The scene numbers below match the scene numbers in the margins of the script for easy reference.

Act I – The Setting

Sequence 1 – Geography

SCENE 1: One of the most striking things about Kennedy Space Center is that all the sophistication of an active space center is located on a vast wildlife refuge. The opening shots reveal the natural beauty of the 140,000-acre Merritt Island National Wildlife Refuge. The space center proper is only about 10% of this area. The music we used here is tranquil to match the shots we filmed of insects, birds, dolphins and manatees.

The way the scene is cut emphasizes the relationship of the space center to its surroundings. There is the gentle harmony of the natural landscape and a sudden appearance of the technological. The shots are interrupted or cut by the sound of a boom then the ascendance of a space shuttle into the sky. The sound effect used here as the

boom at the time of the cut is actually the sound of a grenade launcher taken from the sound effects library.

SCENE 2: In the previous scene the shuttle had launched and the camera movement was an upwards tilt of the camera to follow the orbiter into the sky. So we began this scene by filming a shot of the sky with similar cloud cover and then slowly tilting the camera back towards the ground to reveal the entrance to Kennedy Space Center.

On the morning of that shoot, the KSC security police had blocked a lane of the two lane highway leading to the western gate. We positioned a huge crane, aptly named a "Bronto", in front of the U.S. Astronaut hall of fame. After donning the appropriate rigging, the director, cinematographer and a Bronto operator climbed into the lift basket with a camera and several batteries, supplies and DVC cassettes to record the shot.

We were lifted about 160 feet above the Western gate of KSC. Since the title of the film refers to the nickname of KSC, "Americas Gateway to the Universe", we felt it was appropriate to begin talking about KSC by showing the gate to the space center.

SCENE 3: We chose to include some historical background at this point. Kennedy Space Center was named after President Kennedy who was a great advocate of the space program. The Speech by President Kennedy about his intentions to reach the moon by the end of the sixties is perhaps one of the most recognized speeches about man's endeavor to venture out into space and it aptly describes the purpose for which KSC was created.

We cut from President Kennedy's speech to various shots showing the historical progression of the space program from Alan Sheppard's Mercury flight, to the Apollo program, to a rover on the moon, and finally the Pioneer spacecraft passing Saturn.

The footage was taken directly from NASA historical archives with the permission of the film custodian.

SCENE 4: This is a series of shots taken from a helicopter. The NASA Huey helicopter flew us around the space center to get aerial shots and to provide a scale of reference for the subject of the next scene, the massive vehicle assembly building (VAB). The sound from the real helicopter was so loud that we couldn't use it. The shots were placed in the film without sound and a sound effect track of a Huey helicopter was later added in.

We used the description of the VAB as a segue into the next topic, the cycle that the shuttle follows from assembly to launch to orbit to landing to disassembly and finally back to assembly again.

Sequence II - The Space Shuttle Program:

There isn't really a noticeable transition from the shots showing the cycle mentioned above to the more focused discussion of the vehicle itself. We started the detailed look at the vehicle with the landing phase.

SCENES 5 & 6: Shots of the orbiter landing on the runway at KSC which is part of the "airport" complex called the Shuttle Landing Facility (SLF). Since the orbiter is a glider, it can't make a second attempt at a landing. The pilots have only one chance to land and if the conditions aren't right at KSC they can land at Edward's AFB in California.

There are shots of the orbiter attached "piggy-back" on a NASA-owned Boeing 747. We wanted to include these shots to illustrate one of the landing options. The orbiter can land in California and be flown back to KSC. We were lucky enough to film this procedure live rather than rely on archive tapes.

Another thing the volunteer physicians need to be aware of is that docking the 747 with the orbiter on its back involves a huge scaffold structure called the mate-demate device (MDD) and several dozen technicians working in very dangerous spaces. Any of these personnel can be involved in occupational injuries or trauma during this stage of the mission. The doctors on-site at the time may be called to help these injured personnel.

Discussing the landing gave us the chance to begin discussing the physiology of space flight. If the medical team is involved in a rescue at this stage, many physiologic changes that are “normal” when returning from orbit may mimic signs and symptoms of cardiovascular shock. Deciding which changes result from being “on orbit” and which are signs of trauma can be very difficult.

SCENE 7: The physiology review is brief and is presented in the context of the landing to emphasize how remarkable the landings are given the physiologic impairment of the pilots. The orbiter is shown landing on the runway; then several shots of astronauts working “on orbit” are shown while the narrator describes the physiologic changes that are important for the trauma team to be aware of. At the end of the physiology review, we return to shots of the orbiter on the runway.

There is an interesting “establishing shot” in this scene. An establishing shot is usually a wide-angle shot that reveals the setting or context of the scene. In this shot we see the orbiter on the runway with all the vehicles involved in the convoy positioned around it. The ground convoy is shown at the end of this scene to illustrate how close some of the rescue forces will be during the landing and the type of equipment that will be available near the runway.

We conclude the physiology discussion here as we watch an astronaut walking carefully towards one of the nurses after exiting the orbiter onto the crew return vehicle (CRV). At the conclusion of this sequence we mention that the astronauts are ultimately brought to

the Baseline Data Collection Facility (BDCF), which is really a medical clinic with exam rooms, labs and various testing rooms for experiments that allow us to learn about the physiologic changes associated with space flight.

SCENES 8, 9 and 10: In keeping with the theme of cycles, the next three scenes show the details of the "lifecycle" of a Space Shuttle. In Scene 8, there are shots of the orbiter being towed from the runway to a special hangar called the Orbiter Processing Facility (OPF). That's where all the inspections, repairs and re-furbishing takes place. Once the orbiter is made ready for the next flight, it's towed to the VAB.

Scene 9 explains how the orbiter is lifted and mated to the external fuel tank in the VAB. There is a detailed explanation of each component of the Shuttle. Each object is highlighted in blue as the narrator speaks. This was technically very challenging since we had to work with special software to color the video footage, but it turned out well.

In scene10, the orbiter is described as "the astronauts' home away from home." We show the astronauts engaged in various housecleaning activities and all these shots of the astronauts show them in relaxed clothing.

Sequence III - The Emergency Personnel:

The next sequence discusses the various teams of rescuers that the volunteer doctors will be working with.

SCENE 11: Ivonne Galceran-Garcia, a KSC flight nurse, introduces the search and rescue team. She was filmed sitting in the open bay of a Huey helicopter. This gave us problems due to the sound of wind on the runway where the helicopter was parked. We tried to lessen these background sounds electronically but it was difficult to reduce those and keep the voice since they were both on the same sound track.

She narrates the next set of shots showing the rescue team on land, water and air demonstrating that no matter where the orbiter ends up in case of a mishap, this team will be ready to get there and get the astronauts out and away to a safe location.

The final shots in this scene include a dramatization in which the rescue team is searching for a downed astronaut in the scrub around launch pad 39b. They find him and transport him to a waiting bearcat vehicle. This staging was actually part of a larger dramatized rescue that was filmed over 8 hours on location in the bush with actors playing firemen and astronauts. Only small snippets of this were used in the final video.

SCENE 12: The narrator describes the activities of the pad rescue team (PRT). This team is specialized in rescuing the astronauts from the launch pad complex. The video shows the PRT taking the astronauts out of the orbiter and into the slide-wire baskets. These shots were filmed during a training exercise and obtained by us from the NASA archives.

SCENE 13: The narrator describes the triage team and we see shots of the triage site. The triage site places multiple teams of trauma physicians, ER physicians, military flight surgeons, paramedics, firefighters, environmental specialists and their vehicles in a coordinated area. This is the place where the volunteer doctors will be stationed.

We filmed this during a training exercise, and we were lucky enough to have some of the events staged for the cameras. We had one camera being circulated among the triage teams and one in a Bronto high lift about 50 ft above the site.

SCENE 14: Barbara Pavick, a flight nurse, is filmed in the foreground on the day of launch. In the background, the Shuttle is ready for the launch later that day. We thought shooting this shot so close to the Shuttle would give the viewers the idea that we can get pretty close to the Shuttle as we position the medical team.

During this scene we show a schematic. We wanted to show the general location of the triage sites and explain that these locations varied with wind direction and location of an accident site. We had a lot of trouble trying to find a good map of KSC that would show up well on video. What we ended up with was a digital image taken by a heat-sensing camera from orbit given to us by some geographers at KSC. We used the same software to add the red dots onto the video that we used to color the shuttle components earlier.

In this scene we cut back to the triage site and follow the path of an injured astronaut in detail. We tried to give a good insight into the various functions at the triage site and to imply the teamwork ethic involved in rescuing the astronauts.

SCENE 15: We intended to film the civilian spectators on the causeway at KSC just before a launch but because of logistical problems and security we weren't able to. We obtained archive footage of "crowds watching the orbiter" and we selected shots from the very first Shuttle landing on April 14, 1981 at Edwards AFB. You can see that most of the cars, vans and campers in the shot are from the late 70's.

We cut to shots of the KSC ambulance (modern day), and at one point, the Director had the Cameraman lie down on the road to film the ambulance driving by. This shot, called a "worm's eye view" shot was a dramatic device used to segue into Scene 16.

SCENE 16: This is a short scene in the video in which we introduce the role of the Command Center Physician (CCP). It's of interest because the director spent some time giving Dr. Jeff Myers, a real CCP, a crash course in dramatic acting with some noticeable effects in this scene.

SCENES 17 – 22: As often happens in film, these scenes ended up in a different order than that in the script. Each scene introduces a different member of the flight medicine team. The volunteer physicians will be working closely with these personnel and so we made sure it was clear who they were and what they did.

The opening shot is taken from outside the Operations and Check-Out Building (O & C). We used a shot called a "through-the window" transition shot or a track-through-solid

shot (Vineyard p. 65). It takes us from the parking lot, through the window of Dr. Long's office then into the office. We see Dr. Long at her desk as she describes her role.

The next shots are set up in various locations around the O & C Building. We tried to film each member of the flight medicine department in the area where they were most likely to be on the day of a launch.

The sequence goes on to show a scene involving the military teams that participate at the triage site. We also obtained footage of the Para jumpers (PJ's) from Patrick Air Force Base. We had to speak with the commander of the rescue squadron at Patrick AFB to get permission to be there, film there and interview a few of the PJ's.

The sequence ends with Dr. Art Arnold in the launch control center at KSC introducing the role of the Emergency Medical Services Coordinator (EMS). The EMS is the doctor who coordinates all rescue operations.

Sequence IV - Emergency vehicles:

SCENE 23: Creating this scene used a lot of sound effects. It opens with a shot of the vegetation in the wetlands area around KSC. Sound effects of wind, crickets and various insects were added in. The bearcat vehicle emerges from the vegetation to show how well it maneuvers on rough terrain. The sound of the bearcat in this shot is actually a sound effect taken from a "big rig" truck as it shifts gears.

SCENES 24 - 25: This scene shows one of the M-113 armored personnel carriers. It was filmed from various angles as it drove back and forth along a back road. The cameraman was sent into the field with instructions not to pan the camera but instead let the vehicle drive out of the frame. There was some miscommunication and all the shots ended with the camera panning to follow the vehicle. We used a transition effect to cut from one scene to the next since there was no natural end point such as the vehicle leaving the frame.

SCENE 26: This started as a simple documentary style scene with one of the nurses explaining the contents of the triage van. We ended up with several takes of this shot; and, due to technical problems, only one of these had usable audio. The video that went along with that take was greatly under lit. So we were able to take the video from one take and the audio from another take and try to match the two exactly. Because the nurse was following a script and not making up her own lines we were able to do this and match her lip movements with each word on the audio track. The lighting in this shot was natural light with some enhancement from reflectors. We did not have our own lights for this shot.

SCENE 27: This scene shows the crew return vehicle (CRV) from the outside. We then see shots taken inside the vehicle and a nurse explains the interior set up. Since the nurse in this shot was so nervous, she kept forgetting her scripted lines. We told her that we would not film her as she ad-libbed her own explanation of what she was doing. We lied.

It was all shot in one take and the nurse thought she was just practicing for the real shot. She did so well on her own that we never filmed any other shots of this scene.

At the end of the scene we had the CRV driver raise and lower the vehicle up and down in front of the Baseline Data Collection Facility (BDCF) door as we filmed the rise of the vehicle in the doorway like the appearance of some science fiction apparatus.

SCENES 28: This scene describes the various helicopters around KSC. The civilian helicopters were filmed on location at various hospitals in Orlando. The closing shot of a nurse dressed in a color scheme that matches the rescue helicopter was filmed at Patrick Air Force Base in a closed hangar.

Sequence V - The launch pads:

SCENE 29: This scene opens with a shot of Dr. Dan Woodard on the launch pad in front of the gantry that goes to the mid-deck hatch of the orbiter. He explains that the room directly in front of the hatch is called “The White Room”. It’s there that the astronauts and the close-out crew check the suits and get ready to enter the orbiter. The role of the close out crew is explained in the scene.

SCENE 30: This scene reveals the water sprinklers, oxygen analyzers and emergency escape breathing devices along the scaffolding of the launch towers. The mid-shots (shots of actors from the waist up) of the speaker are intercut (shots cut in quick succession) with close-ups of the various equipment this technique is called “cutaway” (Vineyard p. 85).

SCENE 31: In this scene we describe the slide wire baskets that are attached to the launch tower and slide on cables all the way down to the bunkers at the base of the launch pad areas.

SCENE 32: This is a still shot from the helicopter tour we described earlier and the red line was added using the coloring software we described earlier.

SCENE 33: This is a “point-of-view” (POV) shot (Vineyard p. 52) where the camera represents the point of view of an escaping astronaut getting to the slide wire basket.

SCENE 34: This is another POV but this time the camera is mounted directly onto the slide wire basket. As the basket hit the arresting net at the bottom of its run the sound blew out the microphone so we added music over the native sound and made sure there was a loud musical note at the exact instant the basket is seen hitting the net.

SCENE 35: This scene was shot at the bottom of the slide wire basket’s run. This is where the astronauts would end up once they escaped from the launch pad. The scene shows astronauts (actors) jumping out of the basket and running towards the camera. The music for this scene was meant to convey a dramatic situation. There was one. As we show in the outtakes section of the video, one of the actors actually injured his ankle jumping out of the slide wire basket and onto the sand below.

SCENE 36: This scene shows the bunker. The bunker is an important location because it is a reinforced area into which the crew can take shelter and remain protected from hazardous conditions near the launch pad. These shots were hard to light; but, with some careful planning and playing with lighting system, we got decent shots of the inside of the bunker. The music was a military march taken from our music library.

Scene 37: This is the final scene before we see how everything fits together. We see how the astronauts use the M-113 armored personnel carrier to get away from the launch pad to where the medical team is located at the triage site.

ACT II – The Modes:

Sequence VI: The launch Modes (1 through 4)

SCENE 38: This is meant to be an introduction to the next set of sequences. The pace is a little quicker than the previous sequences because the viewer is now more familiar with the people, places and vehicles being referred to.

SCENE 39 (Mode 1): *Launch Emergency with Unaided Escape by the Astronauts*. This scene shows a group of astronauts walking out of the white room and past the camera. One of them is Canadian (more in the discussion section). They go to the slide wire baskets.

SCENE 40 (Mode 2): *Launch Emergency and Astronauts are Aided By the Close-Out Crew*. This scene was filmed at the space center museum, and we can see a mercury redstone rocket in the background over the nurse's shoulder. We tried to get the full moon in the shot too, since this area of the cape is where the Apollo launches were based.

SCENE 41 (Mode 3): *Launch Emergency and Astronauts Aided By Pad Rescue Team*.

This scene was shot in front of one of the M-113's. The vehicle shielded the microphone from the wind.

SCENE 42 (Mode 4): *Launch Emergency With Astronauts And Close-Out Crew Requiring Rescue*.

This is a high angle shot filmed through the ring which is all that is left of the Apollo-1 launch pad after a tragic fire. Dr. Arnold discusses mode 4.

Sequence VII: The landing modes (5 through 7)

SCENES 43 - 45: These scenes are narrated and they review the concept that the landing of the shuttle is an especially dangerous time since the Astronauts have just returned to full gravity and may experience physiologic changes that reduce their ability to negotiate a landing.

The opening shot is actual footage from the heads-up display of the orbiter during a night landing. The scene also has an aerial shot of the Shuttle runway that was filmed for this video from an aircraft piloted by the director. We intercut wildlife shots here to illustrate the proximity of these animals to the runway area.

We included a shot of the convoy arriving at the runway at night and a shot filmed with an infrared lens. These shots are very dramatic but also serve to show that we perform the

same procedures at night that we do during the day. Notice that the ground crew has a set of high powered lights to light the runway area around the orbiter.

SCENE 46 (Mode 5): *Landing Emergency on Runway with Unaided Escape by the Astronauts*. Dr. Phil Scarpa is filmed standing on the open hatch of an orbiter mock-up used for practicing emergencies. The camera crew was in a high lift basket similar to the Bronto. An orbiter mock-up other than the one used at the beginning of the scene is seen next, but this one is at Johnson Space Center in Houston and is used during the astronaut training done there. The astronauts are shown getting out of the orbiter mock-up through a hatch in the roof and repelling down over the side. These shots were obtained through contacts of Dr. Scarpa from the film archive at the Johnson Space Center.

SCENE 47 (Mode 6): *Landing Emergency on Runway with Astronauts Requiring Rescue.* We open this scene with Dr. Tipton in front of a row of T-38's flown by the astronauts from Houston to KSC. Here again, lighting was very tricky because we wanted to film him in front of the jets but that meant filming him with the sun over his right shoulder. The only way we could get fairly good lighting was to reflect sunlight onto him with three different reflectors. He kept his sunglasses on due to the brightness of the reflected light.

Also for this scene, we were able to obtain Channel 2 (Orlando) news footage of an aircraft that landed at Orlando regional airport and had collapsed landing gear (Mode 6 if

that happened to the orbiter). Getting this tape was easily done because the channel 2 editing studio was next door to ours.

SCENES 48 through 50 (Mode 7): *Landing Emergency with Orbiter Down Within 25 Nautical Miles of KSC*. We filmed Mr. Donald Doerr, A NASA Engineer, in front of one of the Blackhawk helicopters with his modified antennas and rescue gear on it. We also used the geothermal map of KSC again and the special software to highlight a target area that shows where a Mode 7 could occur. Most people would probably notice that the crash zone includes several nearby towns.

Since the Mode 7 is divided into off-site and on-site mishaps, we have a flight nurse discussing the "near-in contingency" section of the Mode 7 in a separate scene. We also superimposed a band of video over the scene we filmed. In this band we had the logos of the various regional hospitals we used at the time scrolling across the screen. This was done so that future editions of the film could have different logos and the names were never mentioned in the audio track since the contracted hospitals could change.

We close the sequence with nurse Yvonne Garcia seated on a console inside the Space Center Museum. Behind her we can see the original firing room equipment used on the earliest launches at Cape Canaveral.

SCENES 51 through 54 (Mode 8): In-Flight Emergency Requiring Bailout of Crew.

We opened this sequence with footage of the 1986 Challenger explosion. It was after that tragedy that the Mode 8 procedures were written.

Dr. John Cinco describes a bailout procedure. He is not framed correctly within the shot and we can see only his mouth in the top right corner of the screen. This unusual framing was not done intentionally (more in the discussion).

We also included extremely rare footage of the testing of the orbiter bail out arm. This is a telescoping pole that extends out from the side of the orbiter so that the astronauts can parachute out of a falling orbiter and into the ocean. The tape was sent to us from the film archive at Johnson Space Center.

The final shots of the scene and of the video occur in water. The raft was loaned to us from the astronaut training section in Houston. It was ordered a month in advance but only arrived the night before the planned shoot. The camera was mounted on a fire-rescue boat. The ripple fade effect was used to close the video.

Fade out.

DISCUSSION

The video we made could have been planned, shot and put together in innumerable ways. This is the essence of art. We chose to create a video that would achieve the goal of having a training tool at KSC that future medical personnel could watch and then walk away with an overview of how medical operations were conducted at KSC.

The video took every element in the Emergency Medical Services Plan prepared by Drs. Dave Tipton and Phil Scarpa in December 2000 and brought that document to vivid life through explanations, demonstrations and re-enactments. Before the video, the medical support teams were asked to read this document and become familiar with the NASA jargon, staff members, important locations, special equipment and unique procedures described within its pages. The video made all that much easier to understand. The goal of the project was definitely achieved in that we created a training video. We had hoped to develop a comparison mechanism between the training video and the written document but unfortunately, due to time constraints, we were not able to achieve this.

Kevin McKee, screenwriting expert, defines the unit structure of any story as follows. A series of shots makes up a scene, a series of scenes make up a sequence, a series of sequences make up an act and a series of acts make up a story (McKee, p.35-41). Our video can be broken down this way as well, even though it isn't a story per se.

Every story defines a problem and offers an explanation or solution that allows the characters to grow emotionally. The story here is one of mankind's driven desires to explore the universe beyond our planet and do this safely. The problem is one small variable in the bigger story of our exploration of space; to boldly GO and RETURN from where no one has gone before. As the story of mankind's ascendance into space continues, we will have new vehicles, new methods and new safety procedures. But for now the question is "**What would we do if something goes wrong during the launch or landing of a Space Shuttle**?"

Writing the script:

Screenwriting Guru, Syd Field has said, "Writing a screenplay is a process, an organic, ever-changing, continuing stage of development; it is a craft that occasionally rises to the level of art (Field p. 7).

Writing the first draft began in July of 2000 and ended in September of the same year. It was clear this was to be a documentary but within the documentary genre there exist different styles. We had to decide early on whether the audience would learn about the topic by simply watching the actual events unfold, as in *cinema vérité*, where reality is observed by the camera, or the events would be re-enacted or dramatized for clarity? We also had to decide whether the narration would be in the form of a disembodied voice (voice-over) or if there would be an on-screen narrator such as a host or guide? (Ascher p.222-223).

The original concept for this script consisted of a series of dramatizations strung together by an on-screen narrator, who moved “the story” along. The audience could then follow a set of characters through different phases of the rescue and thereby be exposed to the rescue protocols used at Kennedy Space Center. This was decided against due to the enormous expense of filming it that way.

The production team decided on the familiar format of the “Learning Channel” documentary, with a voice-over narrator and using the actual personnel in their actual locations on the space center.

The budget allocated in the NASA contract with Bionetics was $15,000 and depended on the use of the in-house audiovisual department. We knew early on that shooting the video as written would easily cost 8-10 times that much. The choice was either to re-write the film again to fit the budget (i.e. 5 to 7 minutes) or seek alternative sources of funding and keep the 38-minute script (appended).

The contractor “Bionetics” owned a small video production company in nearby Cocoa Beach. They had been limited to technical productions (i.e. filming rocket and shuttle launches for engineering analysis). Since these were people trained in film production, they were eager to undertake a documentary project.

The studio managers decided it would be excellent exposure for the small studio and possibly help the studio branch out in a new direction with a documentary film service. They decided to underwrite the entire cost of the project. A budget was still necessary for accounting purposes and to keep track of the amount underwritten by the studio.

Locations:

During the filming of the initial wildlife sequences we spent approximately 45 hours filming out in the bush, marshlands and swamps on Merritt Island. Carrying all the film equipment through the marsh looking for wildlife proved a lot more difficult than we thought. Our trucks often got stuck and long treks into the bush with the cameras over our shoulders were common.

From a medical point of view, several crewmembers sustained minor injuries. Dr. Rimawi was called upon to treat contact dermatitis, minor lacerations, abrasions, strains and a case of cellulitis after a crewmember received a puncture wound on the right forearm from thorns while filming insects for the opening sequence.

Towards the end of the opening sequence the animals scatter as if in response to the blast of the orbiter lifting off. That was achieved by having members of the crew scream or wave clothing at the animals so they would scatter. At no time was any animal harmed during the production of this video. A few were annoyed though. A Word to the wise; alligators can charge when provoked.

The video opens with wildlife but few people actually know that it closes with wildlife as well. In the final scene, the narrator is in a raft. The raft was small and soft-bottomed so it resembled a manatee if viewed from below. It was viewed from below by a curious male manatee that has been known to hang around the rescue boats at KSC. During the filming this manatee chose to chew the anchor rope and abruptly yank the raft out of the frame or come and rub up against the raft or even pop his head out of the water and into the frame. This illustrates the difficult but fun aspects of working around live animals.

The landing scenes were filmed after we had permission from the Shuttle Landing Facility (SLF) managers to actually set up our cameras at the control tower on the side of the runway. We were very fortunate that during the making of the video, the orbiter landed at Edwards Air Force Base and had to be flown back piggyback on the NASA 747. We set up one camera on a hotel rooftop at cocoa beach and one at the SLF control tower. Some of the shots of the 747 aircraft with the orbiter on its back were taken at the Mate De-Mate device (MDD). These shots were filmed by having members of the crew roll up their pants and stand in a small waterway near the MDD which gave us the best view from which to film the action.

During the description of the mode 4, we open with a shot filmed through a giant ring. This is an historic site on KSC and a tourist attraction. The day before the planned shoot, the director had a dream in which he filmed this scene looking down through the ring where the Appollo-1 fire left a scarred launch pad after a tragic fire. With last minute

notice, the Bronto was called for and the location was changed from the space center museum to the ring left by the Appollo-1 fire. The tourists stood by as we filmed on-site and sometimes we stood by as their tour group walked around the monument. It was one of the more interesting filming experiences during the project. It was also particularly appropriate that Dr. Arnold was the narrator for that scene because of his deep interest in KSC history.

We also filmed several scenes at the Cape Canaveral Space Flight Museum. This is an historic site more than a museum. We had permission to film there from the curator who accompanied us on the shoots. It was an honor to film our video among artifacts from the various historic legends of manned space flight.

Characters:

One of the major differences between different documentary styles is the use of actors versus the actual subjects of the film. In most documentaries, the subject is basically interviewed and their answers are their own words. In dramatizations, actors play roles and speak scripted words. Since we wanted to include everything mentioned in the EMS manual, we opted for the more controlled approach of having scripted words. However, to keep the documentary feel, we had the real medical staff speak the scripted lines on camera.

There is a good reason why actors are paid so much money (the good ones). It's because speaking scripted lines in a natural way is much more difficult than it appears. The various staff members in the video had fun acting as themselves and generally did a great job given that they had 20 or 30 minutes of instruction from an amateur director instead of formal acting lessons.

Some people made special appearances in the video. Towards the end of the opening sequence, there is a shot from inside a van approaching the KSC gate. The guard who motions the driver through the gate is one of the most popular guards at KSC due in large part to his friendly greetings at the gate. Every morning, thousands of employees are greeted by him. His hand gesture in the film is one of his own unique gestures as he lets people through every day; we just exaggerated it a bit for the film.

In the scene describing a Mode 1, astronauts escape from the orbiter, still on the launch pad, and walk to the slide wire baskets. We get a flash of a Canadian arm patch on one of the astronauts and his visor is open. This is Marc Garneau, the first Canadian astronaut.

In the description of a Mode 7, Mr. Don Doerr is narrating the scene. Since he is an engineer, inventor and all-round mechanical genius, we used a special “beam me up” effect as he appears on screen.

Captain George Hoggard doesn’t appear in the video except while napping in one of the vehicles shown in the out takes section. He has been at KSC for over 40 years and is a legend among the fire-rescue personnel. He is rumored to be one of only three people to ever ride in the slide wire baskets. He drove most of the special vehicles shown in the video.

Vehicles:

There are obviously many special tools and pieces of equipment on a space center. We tried to show as many as we could.

The Bearcat is one of only a handful in the entire world and was very difficult to gain access to. We did have it for a day out in the bush driven by Captain George Hoggard,

leader of the fire rescue team at KSC. Watching this vehicle traverse the rough terrain on video is the most effective way to describe this peculiar vehicle to the volunteer doctors.

The platform bus called the CRV or Crew Recovery vehicle is a rather mysterious vehicle. It's used at a few airports around the world and we called Montreal Dorval (now Pierre Elliot Trudeau Airport), Montreal Mirabel Airport, Dulles Airport in Washington, D.C., Charles De Gaulle Airport in Paris and no one in any of those places knew what the proper name of this vehicle is nor who makes it. It also wasn't on the internet when we searched for information about it. We were able to obtain access to the CRV for an afternoon. That meant that all the scenes requiring the CRV had to be filmed quickly and at one time.

In scene 46, Dr. Tipton is standing in front of a row of T-38 jets. These jets had just arrived from Houston, piloted by the astronauts. We actually had to get permission from one of the launch directors to get access to the tarmac while the T-38's were parked there.

Physiology:

An essential element of good aerospace medical practice is a solid understanding of human physiology and the changes that occur when humans traverse different environments.

Embedded in the video is a brief review of the physiologic changes that the trauma team has to keep in mind as they assess any injured astronauts. This is very important since changes to the astronauts' physiology from being in space mimic what we find in trauma victims. The volunteer doctors must get this concept and remember it when examining a traumatized astronaut.

In Aerospace medicine theory we are taught the following:

"Orthostatic dysfunction became a greater concern when the United States embarked upon the Space Shuttle Program in the early 1980's, because for the first time the returning Space Shuttle crew were subjected to gravitational stress along the body's Z-axis (head to toe) during the critical reentry period. Because crewmembers must be able to land and exit the shuttle, countermeasures have been evaluated and used to limit orthostatic deconditioning" (Nicogossian p. 291-292).

One of the key physiologic changes mentioned in the video is the “cephalad fluid shift” which is part of the mechanism for the above-mentioned orthostatic deconditioning.

Furthermore, “When an individual first enters weightlessness, fluids shift toward the head and torso because the mechanisms that normally counter the pooling continue to act unopposed by gravity. This fluid shift distends the central vasculature, which contains the primary sensors for the cardiovascular system, causing the body to sense a fluid-volume overload (Nicogossian p. 286-287). This leads to a decrease in plasma volume.

This causes the orthostatic intolerance and may predispose the astronauts to syncope and other physiologic malfunctions. During a landing, this would be catastrophic.

NASA has several countermeasures for this effect. According to Dr. Nicogossian’s book, astronauts are instructed to drink 32 oz of water or juice and swallow 8 salt tablets after the de-orbit burn, approximately 1 hr prior to reentry (Nicogossian p. 292). The Astronauts also wear G-Suits during the reentry phase to prevent orthostatic intolerance.

In some scenes we show the astronauts engaged in everyday tasks. Wearing casual clothing on orbit was meant to remind the viewers that the environment inside the orbiter is pressurized is 14.7 PSI (sea level) and that the orbiter is pressurized with air which is approximately 80% nitrogen and 20% oxygen (Nicogossian p. 116). There is so much work put into aircraft and spacecraft cabin environmental conditions that the concept of “cabin comfort” has become an important aspect of aerospace engineering.

Technical Aspects (Lights, Camera, Sound, Action):

There is a reason why there are academy awards for sound and lighting. We learned this the hard way. Many of the shots were under lit because we filmed on location, outside at KSC. The sunny backgrounds often gave the speakers a darker look in the video. We needed much more lighting than we had. We had some studio lights and solar reflectors which we used on every shot but still we should have used more lights.

The natural sound on the video was a mess. We didn't have telescopic microphones on long booms like we often see in behind the scenes footage of big productions. We only had the microphones that came with the cameras and the small clip-on microphones we bought at radio shack. Neither was good enough to combat the effect of the constant wind at KSC. It plagued us for the whole production. We had to record some lines in the sound booth to salvage what were otherwise good shots.

Camera placement was a very interesting learning experience on this production because in documentary film the camera is often an observer of action rather than a part of it as in dramatic filming. In a documentary, the action usually occurs entirely within the frame and there are few shot changes or cut-away shots.

Director John Boorman described this when he stated that, "Deciding where to set the camera is both a very logical process – where the question of point of view is very

important – and a very intuitive one." He goes on to describe early film work and camera placement which was simply placing the camera where the audience would sit if watching a stage play and letting the action unfold in front of the camera. Director Boorman also goes on to say, "You can imagine what happened when (D.W.) Griffith (silent film era director) started moving the camera…this gave cinema another dimension altogether (Tirard, Laurent p. 8).

During the production, we had the camera placed in various vehicles, we flew the camera on a helicopter and on a rented Cessna 172, we strapped it to cars and dollies and wheelchairs and even lay down with it on the centerline of the road. We wanted the movement of the camera to mimic the movement of the medical teams as they got to the rescue site by all means necessary. We achieved this and no camera was dropped from any moving vehicle.

Launch Pads 39A and B were accessible with security clearances, as were the bunkers at the base of each pad. The difficulty was filming the slide wire baskets. According to Capt. Hoggard, only three human beings (and many stuffed astronaut suits) have ever ridden in them so getting in one to film the experience was out of the question.

It just so happens that a CNN film crew was also filming a documentary about KSC at the same time we were. They wrote for and obtained exclusive permission to mount a camera to the slide wire basket that was being checked prior to a launch. Through professional courtesy and some begging, we obtained the film from that check ride. It

was definitely a lucky break. The sound in the video was added in during postproduction because the CNN crew gave us video but no sound because the sound of the basket hitting the net was loud enough that it blew the microphone.

Another event of note happened during the filming of this sequence. One of the actors we had playing the role of an astronaut was a medical student. He injured his ankle during a stunt. This stunt was rehearsed a number of times without incident. The irony is that later that same student was accepted for an orthopedic surgery residency. This is why in some shots of the astronauts getting into the bunker there are three astronauts and in some other shots there are only two.

In the final scene, Dr. John Cinco is describing the bail out during a Mode 8. There were two cameras filming this. Having the same scene filmed from multiple cameras is called “coverage”. One of the cameras had a faulty battery pack so the only usable shots were the close-ups. These were only intended to be used as cut-away shots from the main set up of Dr. Cinco holding a model orbiter while he talked. The result is that this scene has a talking mouth in the upper corner rather than a full person talking.

Outtakes:

Our project involved 120 people working together at various times, under pressure, for seven months; there were many unforeseeable moments of chaos. Some were funny at the time and all became funny over time. We included a few here just for fun. They are also educational because they show some of the snags one can run into during the making of a video.

CONCLUSION:

We achieved what we set out to achieve; we created a video that illustrates the procedures in the EMS manual in an interesting and effective way. Whether it is actually a more effective way to learn this material is subjective. We strongly believe that modern students have seen so much documentary and docu-drama that this format has become at least as intuitive as reading. The EMS manual is appended here as well as a copy of the video. You be the judge. Enjoy.

Epilogue:

It would definitely have been easier to mail the EMS manual to the volunteer doctors and hope they read it before they arrived at KSC. For the people who worked hard on this video for many long hours over many long months and especially for those who gave up some of their Christmas holiday time for this production, their work was validated by the seven national awards the video has won since its release.

These awards include the prestigious Telly and Axiem awards that recognize excellence in corporate and educational video.

Many thanks to all involved and most of all to those who taught me something about life, art and the interaction of the two!

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APPENDIX 1

The following appendix contains the original video script for Guardians of the Gateway.

The scenes are numbered but the pages are not, to avoid confusion.

(Guardians of the Gateway)

by
(Nidal El Rimawi, M.D.)

(KSC EMS Plan revision E)

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Guardians of the Gateway: A Nidal El Rimawi Documentary

ACT 1: THE OPENING

Kennedy Space Center: The Gateway

1 EXT. APPROACHING KSC GATE - DAY 1

It is Dawn at KSC. Wildlife can be seen quietly grazing in the early morning light. The silence is suddenly broken by the roar of the shuttle launched into the infinite sky. Camera follows shuttle until it disappears out of the top right of the frame.

DISSOLVE TO:

The camera looks skyward suggesting the area where the orbiter disappeared. The camera pans down to reveal the scene 100 ft. above the west gate. The sign announcing entry to KSC is seen. Zoom in on vehicle approaching gate.

DISSOLVE TO:

2 INT. VEHICLE APPROACHING GATE - DAY 2

We look out the front windshield and over the hood of the car. We slowly approach the gate house. The guard exits, checks our ID then salutes and waves us by.

NARRATOR
Every day, thousands of personnel enter the Kennedy Space Center. They are part of the massive work force participating in the exciting endeavor of launching vehicles into space.

NARRATOR
Cape Canaveral Air Force Station and Kennedy Space Center have been the home of America's manned space launches since the 1960's.

DISSOLVE TO:

We watch the footage of President Kennedy's "to the moon before the end of the decade" speech.

DISSOLVE TO:

A Saturn V is launched and slowly rises out of the frame.

CUT TO:

A Voyager type spacecraft flies by Jupiter.

NARRATOR
3 In May of 1961, Alan Shepard became the first US astronaut in Space. From 1968 to 1972 we watched as man reached out to the moon in the Apollo program. With over 40 years of manned space flight operations, and hundreds of unmanned flights, Kennedy Space Center has earned the nickname,AMERICA'S GATEWAY TO THE UNIVERSE. 3

CUT TO:

3 EXT. AERIAL VIEW OF KSC FROM HUEY - DAY 3

Sound of a helicopter (faint in the background) We are in a NASA Huey flying over KSC. We can see the ocean, the launch pads and the enormous Vehicle Assembly Building (VAB). Lush foliage and waterways surround the buildings of the industrial area and specialized buildings.

NARRATOR
Kennedy Space Center is located on Merritt Island. It occupies about 140,000 acres and shares the land with the Merritt Island National Wildlife Refuge. View of the VAB rising from the fields in the forground as seen from the Happy Creek dirt road area.

NARRATOR
Here among the numerous launch complexes are over 500 species of wildlife, including several that are protected. Biologists monitor the coexistence of this unique juxtaposition of nature and high technology.

CUT TO:

4 INT. VEHICLE DRIVING ON CAUSEWAY & VAB ROAD - DAY 4

High spirited music. Our vehicle drives on the causeway beyond the west gate, VAB in the background. Views from front and left side windows.

DISSOLVE TO:

Driving on the SR 3 N road with the enormous VAB in the distance ahead of us.

NARRATOR
The vehicle assembly building is a prominent structure at Kennedy Space Center. It is one of the most voluminous buildings in the world. It is also where the Shuttle is mated to the external tank and solid rocket boosters. It is here that the assembled shuttle begins its journey to the launch pad for launch.

CUT TO:

THE SHUTTLES

5 EXT. LAUNCH T MINUS 6 SECONDS 5

The sound suppression water flows. The orbiter's main engines ignite with a tremendous shudder. A voice can be heard announcing the various stages of the launch sequence. The SRB's ignite and the Shuttle lifts off and clears the tower. It hurtles through the sky towards space, leaving a thick trail of white streaming behind it.

NARRATOR
After the mission in orbit is complete, the orbiter returns to Earth where the process of preparing it for another mission can begin again. The orbiter may land at a number of designated sites, however Kennedy Space Center is the primary landing site. It is also where the orbiter is returned if does land elsewhere.

CUT TO:

6 EXT. ORBITER ON RUNWAY - DAY 6

Dramatic music. We watch the NASA's Boeing 747 approach and land at the SLF with the orbiter attached.

DISSOLVE TO:

The 747 and orbiter are very carefully maneuvered into the

7 EXT. MATE-DE-MATE DEVICE - DAY 7

NARRATOR
In the rare event that the orbiter lands somewhere other than Kennedy Space Center and has to be returned atop a modified Boeing 747 jet. Both craft are slowly and carefully docked into the Mate-Demate Device where the orbiter can be removed and lowered to the ground. After a nominal landing at KSC, the orbiter glides to a landing under the able control of the flight crew.

A voice is heard announcing the stages of the landing phase. The orbiter flies a steep approach as it centers on the SLF runway. We see an orbiter on final approach. It lands on the SLF runway with a puff of white smoke, the drogue chutes open to slow it down. Finally it comes to a stop. Heat ripples the air above the runway surface and venting fumes can be seen emanating from the orbiter.

NARRATOR
Landing the 40 ton glider after a trip in space is one of the most remarkable feats in aerospace operations. Considering that the vehicle as well as the crew have been through the extreme environmental changes of launch, on-orbit and re-entry operations.

NARRATOR
Upon return to earth the astronauts are usually low on fluid volume. While in space, intravascular and extravascular fluids shift towards the head and chest. Pressure sensors in the great vessels of the neck and the atria of the heart detect this shift. The sensory cells are in effect fooled and seem to detect a fluid overload.
(MORE)

NARRATOR(cont'd)

The body's response is to cause the loss of body fluids mainly through diuresis.

Astronauts are examined post-flight and exit the Crew Transportation Vehicle. (alt- crew exits the CTV)

NARRATOR
Other physiologic changes make the landing seem even more remarkable. The crew may experience changes in muscle fiber functioning, neurosensory changes and changes in cardiac function. This physiologic adaptation to spaceflight poses a challenge to performance as the crew returns to full gravity. This could also be a critical factor if an emergency were to occur.

NARRATOR
The ground convoy approaches the orbiter. A team of suited ground crew members cautiously examine the exterior of the orbiter, monitoring the toxicity of the exhaust plume.

NARRATOR
If an emergency were to occur at any point during the launch or landing, medical forces working with rescue teams and NASA managers will react to quickly and effectively render care to any flight or ground crew.

CUT TO:

8 EXT. SHUTTLE PROCESSING FACILITY - DAY 8

An orbiter is returned to the OPF. Split screen view of the orbiter being towed and the CTV being mated to the BDCF.

NARRATOR
After the landing, the crew is returned to the Baseline Data Collection facility in the same building as their crew quarters.

NARRATOR
The orbiter is returned to one of the three bays at the Orbiter Processing Facility.
(MORE)

NARRATOR(cont'd)

Here the vehicle is inspected, maintained and prepared for another flight.

FADE OUT.

9 INT. VAB SHUTTLE BEING ASSEMBLED 9

Inside the VAB, a massive crane lifts an orbiter above our heads. The orbiter is slowly positioned into place.

NARRATOR
Once the ground crew are sure the orbiter is ready for the next phase of operations, it is taken into the huge Vehicle Assembly Building. Here it is lifted by massive cranes and placed on the mobile launch platform where it is mated to the external fuel tank and the solid rocket boosters.

CUT TO:

The Shuttle rolls out from the VAB on the mobile launch platform and is propelled by the massive crawler.

DISSOLVE TO:

10 EXT. CRAWLER TRANSPORTING SHUTTLE TO LAUNCH PAD - DAY 10

We hear the sound of rocks being crushed under the enormous treads of the crawler. LOW ANGLE: We look upwards from the road surface at the massive complex slowly crawling down the pathway towards the pad.

NARRATOR
The Space Shuttle has been called the most complex machine ever built by mankind. Each space shuttle is made up of three components;

The external tank is highlighted

NARRATOR
The large external fuel tank provides 1,750,000 gallons of liquid hydrogen fuel, and liquid oxygen oxidizer which are needed by the three main engines on the orbiter.

The two SRB's are highlighted

NARRATOR
The second component consists of the two solid rocket boosters. Each booster generates 2.66 million pounds of thrust. Together they generate 82.5 % of the total thrust at lift-off.

The orbiter is highlighted

NARRATOR
Finally the shuttle is completed by the addition of one of the orbiter vehicles. The current US fleet consists of four sister orbiters. They are the Columbia, Atlantis, Discovery and Endeavour.

NARRATOR
The Orbiter is the astronauts' home away from home as well as their laboratory and work platform. The crew cabin consists of a flight deck, mid-deck and a lower level equipment bay. The cabin is pressurized to a sea level pressure of 14.7 pounds per square inch plus or minus 0.2 pounds per square inch. The atmosphere is made up of 80 % Nitrogen and 20 % Oxygen. This minimizes the chance of decompression sickness.

DISSOLVE TO:

The Guardians Fire rescue personnel are seen preparing their equipment

NARRATOR
Among the thousands of personnel who work at Kennedy Space Center, there are people whose expertise may be called upon in an emergency.

DISSOLVE TO:

11 EXT. MDD SAR TEAM STAGING AREA - DAY 11

Medical 1 sits on the edge of a Huey helicopter, doors open.

MEDICAL 1
The search and rescue team are one of the groups ready to respond in an emergency situation. This team is made up of highly trained fire/rescue specialists. The members of the rescue team wear a chemical protective suit with an air pack and carry specialized rescue gear. The SAR team checks their gear and take their post, ready to respond.

DISSOLVE TO:

SAR team members advance in rough terrain (Happy Creek) towards an unseen crash site.

MEDICAL 1
(voice over)
They have specialized training on how to access the orbiter and assist the crew in egressing the vehicle. They are relied upon to perform a rescue, if needed, during a nominal landing or in the unlikely event of an off-runway landing of the orbiter.

MEDICAL 1
(voice over)
The rescue team are in radio contact with the NASA Mission Managers and the Emergency Medical Services Coordinator.

CUT TO:

12 EXT. LAUNCH PAD - DAY 12

The pad rescue team in bunker gear run along the 195 foot level to the equipment locker (passing the camera) and then to the white room.

NARRATOR
Another special team is the Pad rescue team. These are also highly trained fire / rescue personnel. They have training in rescue operations on the complex launch pad area.
(MORE)

NARRATOR(cont'd)

They would have to respond in a launch pad emergency by opening the mid-deck hatch on the orbiter and assisting the crew to egress the orbiter. They are trained to rescue the close out crew as well as the flight crew.

Close up view of the crew with their gear on.

NARRATOR
They wear protective bunker gear during the rescue and work to quickly get everyone off the launch pad and down to the safety of a protective bunker.

CUT TO:

View of the pad from a distance

CUT TO:

13 EXT. TRIAGE SITE - DAY 13

We hear the hustle and bustle of the triage area activities. In the background we hear the pulse on a cardiac monitor. Personnel are moving quickly to treat the victims. We follow an astronaut on a stretcher being brought in and assessed.

NARRATOR
Medical forces at Kennedy Space Center are made up of several teams taking on different roles during the emergency. Near the launch pad, is the triage team. This team are under the command of the Triage Doc. This is usually a physician from Kennedy Space Center's Occupational Health Services. Working with the triage doc is a staff of physicians, nurses, paramedics, and support personnel trained in trauma and emergency procedures.

CUT TO:

14 EXT. TRIAGE SITE, BEACH ROAD - DAY 14

Medical 1 stands on Beach Road with the pad behind them. Wind blows.

MEDICAL 1
There are many locations on Kennedy Space center which are suitable to set up a triage area.

CUT TO:

We see a blank map of KSC. The numbers of the launch triage sites fall from beyond the screen as if falling from the sky and land on the map.

MEDICAL 1
(voice over)
During Launch, we have set aside certain areas for use as potential triage areas...

The letters of the landing sites fall onto the map similarly.

MEDICAL 1
(voice over)
...There are also multiple sites available for use during a landing which are located at sites more appropriate for landing.

CUT TO:

The windsock at the Beach Road site blows in the breeze behind medical 1. The Shuttle pad is seen in the distance.

MEDICAL 1
The best possible triage site is selected taking into account the overall situation, the prevailing winds and the proximity to the emergency event.

CUT TO:

Triage site being set up. The triage site is full of activity as patients are assessed, stabilized and one is transported on a gurney to a waiting medevac helicopter.

MEDICAL 1
(voice over)
The triage medical team is responsible for life-saving care, primary survey of the patients and transport to definitive care.

MEDICAL 1
If there are injuries the triage team may elect to send the patient to a nearby trauma center or emergency room. The patients can also be decontaminated if toxic exposure is suspected.

CUT TO:

The decontamination crew working in protective suits, assess a potentially contaminated patient. Decon water is sprayed on the patient.

MEDICAL 1
(voice over)
The crew is initially brought to a decontamination area where they are checked for exposure to any of the toxic chemicals used on the orbiter. If they are contaminated, they will be decontaminated with water.

The team continues to decon the patient and monitor.

MEDICAL 1
(voice over)
The decontamination area is manned by two advance paramedics, the environmental health team and firefighters.

DISSOLVE TO:

The firefighters wash down a patient.

MEDICAL 1
(voice over)
The firefighters, also in full protective gear, use water from the fire vehicle to wash down potentially contaminated personnel.

We watch a victim being decontaminated and assessed for breathing and pulse.

MEDICAL 1
(voice over)
The advance paramedics perform airway, breathing and circulation surveys on arriving patients and monitor patients during decontamination.

DISSOLVE TO:

The triage team accept the patient and begin the medical care.

MEDICAL 1
(voice over)
The remote and mobile environmental health team is a group of environmental health specialists trained in the detection and monitoring of toxic materials. They examine patients for contaminants prior to clearance into the "clean" triage area.

DISSOLVE TO:

Medical 1 standing once again on the beach road triage site.

MEDICAL 1
After the environmental health team decides that the patients are no longer at risk from toxic contaminants, they are turned over to triage personnel on the clean side of the triage site. The final step after decontamination and an initial medical assessment and emergency care is to bring the patients to definitive medical care.

CUT TO:

15 EXT. CAUSEWAY - DAY 15

Crowds of spectators line the causeway to watch the launch. We see the exterior of the Occupational Health Facility (OHF).

NARRATOR
With thousands of spectators and personnel waiting to watch the launch.
(MORE)

NARRATOR(cont'd)

The medical forces must remain vigilant for any medical problems. The physicians, nurses and paramedics of the Occupational Health Services work together to monitor the Space Center...

CUT TO:

16 INT. OHF COMMAND POST 16

The command post MD speaks into the radio at the OHF.

NARRATOR
...The mobile forces supporting the visitors work with the command center physician in the occupational health facility. From here the command post physician can speak to any of the other medical or rescue forces on the radio.

CUT TO:

17 EXT. O & C BUILDING - DAY 17

We stand at the street level in the front parking lot. Wide angle. Dramatic music plays. The camera pans upwards and to the left. Zoom in on third floor windows.

NARRATOR
Here in the historic operations and check- out building in the heart of Kennedy's industrial complex are the offices of the medical operations team.

DISSOLVE TO:

The KMD (Kennedy Medical Doctor) sits in an office with the checklist and calls all the hospitals, radios can be heard in the background.

MEDICAL 3
When we occupy the post of KMD or Kennedy Medical Doctor, we are responsible to the emergency medical services coordinator

18 INT. HOSPITAL COMMUNICATIONS AREA 18

MEDICAL 3
The KMD calls all participating hospitals and verifies that their helipad is operational and that their critical care units are able to accept patients that day. The KMD also calls county emergency services and verifies that they are monitoring the radio frequencies we will be using and that they are ready to assist.

A helicopter lands at one of the local hospital's helipads.

MEDICAL 3
(voice over)
Once these calls are made the KMD contacts the Emergency Medical Services Coordinator to tell EMS that local emergency services and hospitals are standing by.

MEDICAL 3
During a medevac, the KMD also coordinates the communications with the hospitals to ensure that the receiving hospital is aware of incoming patients and their condition.

DISSOLVE TO:

19 INT. CREW QUARTERS 19

Both KRNs (Kennedy Registered Nurses) are seen in split screen, each doing similar tasks. One on the CTV and one in the BDCF.

MEDICAL 5
The Kennedy Registered Nurse, or KRN, is also designated prior to every mission. The KRN has the following duties: During a launch the KRN supports the Crew surgeon in final briefings, exams, and general medical support issues.

MEDICAL 5
During the landing phase one KRN is stationed aboard the crew transport vehicle, or CTV, at the landing site and one is at the Operations and Check Out Building.

MEDICAL 5
The KRN will assist in post flight exams, assist in getting the crew ready for post- flight activities. The KRN will also assist in getting the crew back to their families once all the post-flight checks are completed.

MEDICAL 5
The KRN is available at other times to address crew family issues while the families are at KSC.

CUT TO:

20 INT. DR. LONG'S OFFICE 20

"Dr. Irene Long - Chief Medical Officer" Dr. Long sits at her desk.

DR. LONG
The medical operations physicians train for many different emergency response scenarios. Periodic emergency simulations are run in order to identify areas for improved training.

Physicians are seen in various class and on-station training.

DR. LONG
They also participate in training sessions to keep up to date on their knowledge of the equipment and procedures. Training courses on space suit removal, advanced medical kits and Shuttle toxicology are given here and at Patrick Air Force Base. The military training is given under the auspices of the DDMS, the Department of Defense Manned Spaceflight Support Office.

CUT TO:

21 EXT. SLF STAGING AREA 21

Helicopters are stationed at the SLF with military personnel seen preparing their equipment.

NARRATOR
The Department of Defense also has medical personnel on hand at Kennedy Space Center to respond with military assets in case of emergency. Personnel include military Flight Surgeons and medics. The medics are actually specially trained para-jumpers called PJ's.

CUT TO:

We watch the PJ's in action, extracting a patient, jumping into a rescue area and working with the helicopters.

NARRATOR
The PJ's are military trained medics who specialize in combat medicine and remote search and rescue. The PJ's and Department of Defense physicians may evaluate the crew at the crash site or on board specially equipped helicopters. The military medical team is in communication with the Support Operations Center and the EMS in the Launch Control Center.

CUT TO:

22 INT. LAUNCH CONTROL CENTER 22

The LCC is full of personnel managing the mission.

NARRATOR
Communication with all the medical forces are monitored here in the LCC by the Emergency Medical Services Coordinator. The EMS sits at a console in the firing room.

MEDICAL 7
One of the key roles we play at the medical operations office is the role of EMS. Here we communicate and coordinate all medical response to an emergency.

MEDICAL 7
Sitting with us at the console is the biomedical engineer who assists with technical, biomedical and life-support issues. Also sitting with us is the deputy crew surgeon from Johnson Space Center.

We see the crew surgeon and the DCS near the crew quarters. (alt. In the crew quarters)

MEDICAL 7
(voice over)
The Crew surgeon and the deputy crew surgeon are the primary care physicians of the crew. They are familiar with the crew's medical history.

MEDICAL 7
In an emergency they provide essential information for the medical team. The EMS can call upon any of the unique resources here at KSC to participate in an emergency.

CUT TO:

Emergency Vehicles

CUT TO:

23 EXT. TRAIL AT HAPPY CREEK - EARLY EVENING 23

The wind blows gently through the vegetation at the trail area. Insects are seen in the twilight. Suddenly the Bearcat appears, easily navigating the rough terrain.

NARRATOR
This peculiar vehicle is the Bearcat. It is an amphibious, tracked all terrain vehicle. It carries medical personnel and has room for multiple patients. It also has two sections which can be towed behind it, a second crew compartment and a power generator.

CUT TO:

24 EXT. BUNKER - DAY 24

The M-113 armored personnel carrier is heard firing up. The vehicle is seen from several angles.

NARRATOR
Kennedy Space Center also operates four armored personnel carriers, M-113's. These are referred to in radio communications as “Hard Tops”.

We enter the vehicle.

NARRATOR
It can hold 5 rescue personnel and two patients inside their armored shell, although it may hold more or less in various configurations. The crew can use these vehicles to escape from the immediate area of the launch pad to get themselves safely to the remote triage site.

CUT TO:

25 EXT. KSC ROAD - NIGHT 25

An ambulance drives past the camera with sirens and lights operating.

CUT TO:

The convoy drives past the camera with several fire trucks, light generators and other vehicles.

CUT TO:

26 EXT. TRIAGE VAN 26

Medical 5 stands near the triage van and opens the doors.

MEDICAL 5
The triage van is an essential part of the medical convoy. It contains medical supplies and equipment needed at the triage site.

CUT TO:

27 EXT. CTV PARKING AREA 27

Medical 5 stands at the base of the CTV and goes up the ladder into the rear door. Medical 5 sits in one of the chairs. Interior views of the CTV.

MEDICAL 5
The Crew Transport vehicle is a very special vehicle. It can hold multiple personnel including a full orbiter crew. As you can see, there is plenty of room in here to hold the crew, and all the support personnel needed to interact with them after their return from space.

We see the BDCF Door in the “middle of nowhere" on the wall of the Operations and Checkout building. Suddenly and slowly the CTV is seen docking with the BDCF door. The CTV is elevated and the camera zooms out to reveal the position of the CTV in relation to the building.

MEDICAL 5
(voice over)
The CTV is remarkable because it can be raised and lowered to dock with either the orbiter mid deck hatch or the doors of the Baseline Data Collection Facility.

Medical 5 stands inside the doors of the BDCF.

MEDICAL 5
Once the crew are here at the BDCF, they are examined and any medical testing is performed before returning the crew to their quarters.

CUT TO:

28 EXT. SLF - DAWN 28

The helicopters are lined up at the SLF staging area silhoutted against the rising sun. Careflight helicopter lands at a hospital helipad. Firstflight helicopter in action.

MEDICAL 5
(voice over)
The department of defense provides helicopters for support of launch and landing operations.

MEDICAL 5
Civilian helicopters from nearby hospitals or emergency services may also provide support when needed. They may be on station at KSC or called in when required. In any case they are ready to support emergency operations. Their expert services are considered a valuable addition to the emergency medical services team.

Focus on the NASA Huey.

MEDICAL 5
(voice over)
In addition to the DOD and civilian helicopters, NASA may use any of it's own Huey helicopters. One of the NASA Hueys is used as a mobile command post, allowing the medical forces to have eyes in the sky.

Medical 5 sits on the edge of the NASA Huey.

MEDICAL 5
In certain contingencies such as a remote landing the Rescue operations Commander, or ROC, may serve to direct medical forces to the landing site.

MEDICAL 5
The ROC may also designate a remote triage area. During a launch the Huey surveys the space center for any signs of trouble.

CUT TO:

Launch Pad

29 EXT. LAUNCH PAD - DAY 29

Dramatic music. The sound of wind blowing through the metal structure. Medical 2 stands, leaning on railing near the OAA and white room. In the background is the other launch pad.

MEDICAL 2
The shuttle is launched from one of these two launch pads at launch complex 39, LC 39a or LC 39b.
(MORE)

MEDICAL 2(cont'd)

In the launch configuration access to the orbiter is from this orbiter access arm.

Zoom out to reveal the orbiter access arm.

MEDICAL 2
...which can be rotated to connect the service structure to the shuttle. During an emergency, the arm can be in place in 45 seconds.

Medical 2 points to the white room. Camera pans as we look into the white room and see the mid deck hatch.

MEDICAL 2
(voice over)
At the end of the access arm is the white room. This room provides a workspace for the preparation of the crew and gives access to the orbiter's mid-deck hatch.

CUT TO:

30 EXT. LAUNCH PAD - DAY 30

We watch as the astronauts get ready to enter the orbiter. The close-out crew assists them and can be seen talking to the crew.

MEDICAL 2
(voice over)
The specialists who assist the astronauts prior to launch are the close out crew. The close-out crew consists of suit technicians, hatch technicians and astronaut support technicians.

MEDICAL 2
(voice over)
They verify that the astronauts suits are functioning properly, that the survival packs and parachutes are installed properly and that the crew are secure in their seats.

MEDICAL 2
(voice over)
The close out crew stay until the hatch is closed and pressure tested.
(MORE)

MEDICAL 2(cont'd)

So there is a time when the population of the launch pad consists of both ground crew and flight crew. In an emergency they would all have to escape the fixed service structure.

MEDICAL 2
If necessary, the water deluge system can be activated on the fixed service structure. This spray provides fire extinguishing or decontamination water. The crew and other personnel on the pad could make their way to the escape system even under conditions of toxic hazzard or fire.

CUT TO:

31 EXT. LAUNCH PAD - DAY 31

Medical 2 is standing at the far end of the row of slide-wire baskets.

MEDICAL 2
Also at the 195 foot level, we have seven slide wire baskets. Each can hold up to four people although we usually try to hold three people with equipment during emergency simulations.

CUT TO:

32 EXT. AERIAL VIEW OF LAUNCH COMPLEX W/ ANIMATION 32

We see the launch pad from the air and the sand pit and bunker are highlighted with ANIMATED ARROWS SHOWING THE ESCAPE PATH.

MEDICAL 2
(voice over)
This is the path the crew follows to safety as seen from the air.

MEDICAL 2
(voice over)
The crew can egress the orbiter, run through the white room and across the orbiter access arm following the arrows to this escape system and down to the ground.

CUT TO:

33 EXT. LAUNCH PAD - DAY 33

Dynamic music. The crew members get into the slide-wire baskets for an escape to the ground.

DISSOLVE TO:

34 INT. SLIDE WIRE BASKET - DAY 34

View from inside slide-wire basket as it releases from 195' level and slides earthward towards the sandy strip of land called the arresting pit.

MEDICAL 2
(voice over)
At the bottom of the wire, the basket hits an arresting net. The net slows the basket down by pulling a set of chains through a sand pit.

CUT TO:

35 EXT. SAND PIT - DAY 35

Urgent music plays as we watch the basket come towards the camera at high speed. The basket slams into the arresting net. The heavy chains get pulled out of the sand bringing the basket to an abrupt halt. The crew comes cascading out over the side of the basket into the sand. They run past the camera and out of the frame

CUT TO:

First-person view running from the sand pit to the bunker door. The door is pulled open and we enter the darkness of the bunker.

CUT TO:

36 INT. BUNKER 36

Mysterious music. We are inside the darkened bunker. Sunlight streams in through the open door. Medical 3's voice echoes.

MEDICAL 3
The bunker is a protective shelter and can accommodate the entire crew as well as support personnel. It is reinforced and provides protection from a catastrophic event.

DISSOLVE TO:

A light beam from a flash light helps focus attention on various equipment inside.

MEDICAL 3
(voice over)
In the bunker, we have an array of safety and medical equipment. There are respirators, flashlights, resuscitators, first aid kits, rescue chairs, sensors for detecting toxic hazards, blankets, and a point to point telephone.

DISSOLVE TO:

37 INT. ARMORED PERSONNEL CARRIER 37

MEDICAL 3
The crew are instructed to remain inside the protective bunker if there are no injuries.

MEDICAL 3
In the event of injured personnel, they crew will stay in the bunker with the injured person until the pad area is considered safe. When the time is right to leave the bunker, the crew can use the armored personnel carrier to escape the immediate area and bring the injured person to the triage site.

MEDICAL 3
The crew are trained in the operation of the M-113 and they practice driving it to the triage sites.
(MORE)

MEDICAL 3(cont'd)

It is all part of the training the crew and the emergency response personnel receive to prepare for an unforeseen emergency.

FADE OUT.

ACT 2: THE MODES

Mode 1: Unaided crew escape

38 EXT. LAUNCH PAD - DAY 38

Medical 4 stands at the base level of LC 39.

MEDICAL 4
There are,of course, different types of emergencies which can occur during an event as complex as a launch or landing of a space vehicle. Anything from heat related injuries of visitors watching a launch or landing to an emergency involving the vehicle. In a vehicle emergency, it may be necessary to evacuate the crew. We have divided these types of emergencies into 8 categories which we call modes. Modes 1-4 are situations where the crew has to evacuate prior to a launch and modes 5-7 are evacuations after a landing. Mode 8 is a bail out of the crew during launch or landing. Let us start by examining the launch modes with a description of mode 1.

Pan from the launch complex to Medical 4

MEDICAL 4
If the NASA Test Director declares a Mode One, the crew are instructed to egress the vehicle and to evacuate the launch pad.

DISSOLVE TO:

39 EXT. LAUNCH PAD 39

We are in the white room looking at the orbiter in place on the pad. Camera dollies back away from the white room.

MEDICAL 4
(voice over)
Since a Mode one is an unaided escape by the crew, they are required to exit the orbiter by the best means. This is through the mid deck hatch. After egressing the orbiter, they run through the white room, activate the water suppression system if necessary, and...

DISSOLVE TO:

First person view as we run through the white room to the baskets.

MEDICAL 4
(voice over)
...proceed onto the fixed service structure. Quickly, they arrive at the slide wire baskets. They get into the baskets and slide to the sand pit below the launch pad. Then they take cover in the fortified bunker. They may be instructed to stay in the bunker or go to the M-113, an armored personnel carrier, and drive to the triage site.

DISSOLVE TO:

We hear the sound of steel on concrete. We also hear the instructions to the crew over the radio. View from inside the M-113 driving towards the sign "triage site this way". We watch the armored personnel carrier as it leaves the bunker area towards the triage site.

CUT TO:

Mode 2: Flight crew aided by close-out crew

40 EXT. SAND PIT - DAY 40

Medical 5 stands near the sand pit.

MEDICAL 5
During a Mode 2, there is an emergency situation on the launch pad while the close out crew is still present.

MEDICAL 5
In a Mode 2 The close out crew will assist the astronauts in egressing the orbiter and getting into the slide wire baskets if necessary. Then the whole group will leave the launch pad.

DISSOLVE TO:

We watch the basket sliding away from us to the ground. The bunker door is open and the camera moves past the bunker facing the door.

MEDICAL 5
(voice over)
The bunkers can easily accommodate all the flight crew and the close out crew. The crew then establish contact with the launch control center by point to point telephone.

CUT TO:

Mode 3: Pad rescue team rescues flight crew

41 EXT. ARMORED PERSONNEL CARRIER - DAY 41

Medical 6 stands near hard top.

MEDICAL 6
The Mode 3 is different from Modes 1 and 2 because now we have a situation where the pad rescue team has to be brought in to assist the flight crew. The crew are alone on the launch pad and therefore there is no close out crew to assist them.

DISSOLVE TO:

We watch the rescue team putting on their gear and getting ready to rescue the crew. We watch them running along the 195 ft level to the tool locker and get the hatch opening device.

MEDICAL 6
(voice over)
The pad rescue team get special tools to quickly open the sealed hatch on the orbiter.
(MORE)

MEDICAL 6(cont'd)

They assist in egress, escape and they all take cover inside the pad area bunker.

CUT TO:

Mode 4: Pad rescue team rescues the flight crew and the close-out crew as well.

42 EXT. SPACE MUSEUM - DAY 42

We see Medical 7 standing among the rockets at the museum.

MEDICAL 7
A Mode 4 is the most complex of the launch emergencies. This is a situation where the close out crew and the astronauts are still on the launch pad and there is a critical emergency. They are all up on the fixed service structure and they require rescue forces to assist them.

DISSOLVE TO:

We watch the rescue team assist the close-out crew, get the hatch opening tool and begin to open the mid-deck hatch. We see two rescue team members carry a weakened close-out crew member towards the baskets.

MEDICAL 7
(voice over)
In this situation, the pad rescue team will be sent to the launch pad and they will have to rescue both the close out crew and the astronauts.

MEDICAL 7
Everyone will then descend from the launch pad in the slide wire baskets and enter the bunker. Time is of the essence during this complex rescue, especially in the face of toxic hazards.

CUT TO:

Landing & Landing Modes

43 EXT. AERIAL VIEW OF KSC - DAY 43

Aerial view of the SLF and runway.

NARRATOR
The Shuttle Landing Facility includes a 15,000 ft. runway with a 1000 ft. overrun area at each end. The runway is designated runway 33 / 15, which is an approximately North-West - South-East Runway.

We see the lush foliage and the canals with a large alligator waiting nearby.

NARRATOR
The runway is bounded by canals, marsh land, palm flats and oak hammocks. The orbiter has to land on the concrete of the runway to avoid landing in alligator territory.

DISSOLVE TO:

44 EXT. SHUTTLE LANDING FACILITY - DAY 44

We watch as the orbiter lands at the SLF. The orbiter rolls, drogue chutes open and it comes to a slow stop. Gasses can be seen venting from the orbiter. We hear communications on radio. Landing and Recovery Director is heard on radio.

NARRATOR
The orbiter contains several toxic compounds such as monomethyl hydrazine and nitrogen tetroxide.

NARRATOR
The flight surgeons involved in the medical operations have to be knowledgable on the treatment of exposures to the hazardous materials involved in space operations.

CUT TO:

We see the convoy rushing to the SLF runway. Ground crew work around the orbiter.

NARRATOR
The vented gasses and the intense heat of some of the orbiter's flight surfaces pose a significant hazard to the ground crew. There is a perimeter of a quarter mile around the Shuttle established to protect the ground crew. Only authorized personnel enter this danger area until the area is checked and declared safe for ground operations.

DISSOLVE TO:

We see the NASA convoy commander in the command vehicle talking on a field radio.

NARRATOR
The convoy is under the direction of the NASA Convoy Commander who is stationed in the convoy command vehicle.

CUT TO:

45 INT. LAUNCH CONTROL CENTER 45

We see the LRD in the LCC, on the phone (radio)

NARRATOR
Landing operations are directed by the Landing and Recovery Director.

NARRATOR
If there is an emergency during the landing phase of the flight, the Landing and Recovery Director may declare any of Modes 5 through 8.

NARRATOR
These are emergencies during landing which require the crew to escape from the vehicle. They may be aided or unaided escapes.

CUT TO:

Mode 5: Crew escapes after landing

46 EXT. SHUTTLE LANDING FACILITY - DAY 46

We see Medical 8 standing near the MDD.

MEDICAL 8
(gesturing towards the SLF)
In a Mode 5, The orbiter has landed and there is an emergency situation detected. For example smoke in the orbiter or in the aft bay area.

We see the astronauts egressing the orbiter via the mid deck hatch and slide.

MEDICAL 8
(voice over)
There are two ways the astronauts could get out of the orbiter. The mid deck hatch may be opened and its inflatable slide may be used or the crew may egress via a rooftop emergency egress window.

MEDICAL 8
If they egress via the rooftop emergency window, they have to use a specialized rigging system.

DISSOLVE TO:

We see the crew being trained to egress the orbiter via the rooftop window using the sky genie.

MEDICAL 8
(voice over)
The crew is trained in the use of this system called, Sky Genie, which is a lock and slide mechanism on an escape rope that they can use to lower themselves from the orbiter.

MEDICAL 8
The crew are unaided during their egress from orbiter. They are instructed to run upwind away from the orbiter as much as practical where they are met by fire / rescue teams. The crew will then be taken away from the orbiter as fast as possible towards the triage site.

CUT TO:

Mode 6: Orbiter on runway. Flight crew rescued

47 EXT. SHUTTLE LANDING FACILITY - DAY 47

We see Medical 9 standing on the runway.

MEDICAL 9
In a Mode 6, a problem occurs during the landing or shortly after landing. The crew may be injured or simply weakened after prolonged space flight and require assistance from the rescue team. A Mode 6 is an aided escape from the orbiter.

DISSOLVE TO:

We dolly towards the end of the runway and see the red lights at the end of the SLF runway.

DISSOLVE TO:

A rescue vehicle speeds past the frame towards an unseen emergency

MEDICAL 9
(voice over)
Examples of a Mode 6 would be a collapsed landing gear or runway overrun. In any case a Mode 6 is in an area that is still accessible to ground forces.

MEDICAL 9
The landing rescue leader proceeds to the orbiter with the search and rescue team who then assist in flight crew member egress from the orbiter and transport to the triage site using Kennedy Space Center rescue vehicles.

CUT TO:

Mode 7: Orbiter on / near runway. Flight crew rescue

48 EXT. NASA HUEY - DAY 48

We see Medical 10 sitting on the edge of the NASA Huey with the doors opened.

MEDICAL 10
If the orbiter lands off the runway, outside the area of the canals and within the area of responsibility of Kennedy Space Center, a Mode 7 is declared. In other words, the vehicle is not immediately accessible to the ground forces standing by at the Shuttle Landing Facility.

DISSOLVE TO:

We see an ANIMATION showing an air navigation chart with KSC at center of graphic and a red ring expands outward to depict a 25 nautical mile radius.

MEDICAL 10
(voice over)
The area of responsibility covers a 25 nautical mile radius from the Shuttle Landing Facility navigation beacon, not including the Atlantic Ocean. Operations for an ocean rescue are actually beyond the scope of a Mode 7.

DISSOLVE TO:

We see an aerial view from the huey as we overfly the SLF.

MEDICAL 10
(voice over)
The Rescue Operations Commander or "ROC" sits in a NASA Huey like this one to get a better overall idea of the rescue area and then designates the triage site.

MEDICAL 10
The search and rescue team is transported to the rescue area by the best available means. This means that the triage team may have to deploy and set up a triage site in a remote area.

DISSOLVE TO:

Footage from the Helicopter familiarization demonstration exercise at Patrick AFB

MEDICAL 10
(voice over)
The helicopters are well equipped to drop the necessary rescue personnel or equipment near any remote triage site.

CUT TO:

49 EXT. BEAR CAT -DRIVING 49

We see the Bearcat coming towards us in the bush

CUT TO:

Medical 6 stands near the Bearcat.

MEDICAL 6
For a "near-in"contingency, the search and rescue team loads the crew directly into the Bearcat for transport to a field triage site.

MEDICAL 6
The crew may need to be decontaminated and stabilized for transport in the field. They are triaged at the designated remote triage site where a helicopter arrives. They are then loaded immediately on the helicopter for transport to a medical facility.

CUT TO:

50 EXT. MDD - DAY 50

Rescue personnel get into waiting helicopters at the MDD. One of the helicopters prepares for take-off, the beacons go on, the rotor starts and the craft lifts off.

MEDICAL 6
(voice over)
For a "remote" contingency, where the rescue area is too far to use the Bearcat, we will use helicopters to get to the scene, drop rescue personnel and equipment.

DISSOLVE TO:

We see the PJ's with equipment getting into the helicopter.

DISSOLVE TO:

We see the exteriors of and signs bearing the names of the support hospitals.

MEDICAL 6
(voice over)
The crew may be transported directly to one of the stand-by hospitals ready to accept injured crew members.

MEDICAL 6
These hospitals currently include Orlando Regional Medical Center, Holmes Regional Medical Center in Melbourne and Halifax Medical Center in Daytona Beach, Florida Hospital in Orlando, Parrish Medical Center in Titusville and Shands Hospital in Gainesville.

MEDICAL 6
The Decision whether to take a patient to the triage site or directly to a hospital after extraction from a remote location rests with the flight surgeon aboard the rescue helicopter, in consultation with the EMS.

CUT TO:

Mode 8: In-flight bail-out of the crew. DOD rescue

51 EXT. CHALLENGER ACCIDENT 51

We see the footage of the Challenger accident

NARRATOR
Ever since the 1986 Challenger disaster, medical teams and engineers realized that there should be an improved escape mechanism. Many ideas were explored. The result was that orbiters now have an escape or bail-out system.

CUT TO:

52 EXT. SRB RETRIEVAL SHIP - DAY 52

Medical 11 stands aboard the Solid Rocket Booster recovery ship, holding a model of the orbiter.

MEDICAL 11
(gesturing)
The Mode 8 is a contingency whereby the orbiter cannot make the landing runway. It could occur shortly after launch during an attempt to return to a domestic or transatlantic landing site.

MEDICAL 11
The orbiter can be pointed out into the ocean and the crew can parachute out. The bailout may occur at a very high altitude.

MEDICAL 11
This is one of the reasons why the crews now wear pressurized launch and entry suits versus the blue Nomex flight suits worn by crews on launches and landings prior to the Challenger accident.

Close Up on Medical 11's hands and the model.

MEDICAL 11
(holding the model)
If the crew just open the hatch and jump out, they can strike the orbiter's wing. The present mechanism consists of a mechanically deployed escape pole which is extended after the mid deck hatch is opened...

CUT TO:

53 EXT. C-141 FOOTAGE 53

We see the system being used by PJ's in a C-141

MEDICAL 11
(voice over)
The crew are trained to attach a lanyard on their flight suits to this egress pole and slide along until they clear the orbiter.
(MORE)

MEDICAL 11(cont'd)

This way they are dropped below the level of the wing and safely parachute into the ocean.

MEDICAL 11
They are trained for high level parachuting as well as ocean survival. Each crew member has the necessary survival gear attached to their flight suits for ocean survival and rescue. This includes limited medical supplies, a transmitter beacon, rations and a raft.

CUT TO:

54 EXT. RAFT - DAY 54

We see Medical 11 floating in raft.

MEDICAL 11
Rescue during a Mode 8 is directed by the Department of Defense Manned Spaceflight Support Office. They have a team at the support operations center on Patrick Air Force Base.

MEDICAL 11
If the operation is carried out near KSC, the Emergency Services Coordinator may assist the DOD flight surgeons during the rescue.

CUT TO:

Various shots of different aircraft in rapid succession.

MEDICAL 11
(voice over)
The DDMS coordinates with other services to provide helicopters, fixed-wing aircraft and ships as needed.

MEDICAL 11
There may also be a Coast Guard Cutter and a Coast Guard Falcon jet involved.

MEDICAL 11
NASA also has two ships, the Freedom Star and the Liberty Star, that serve as the retrieval ships for the booster rockets. These ships may also join a rescue effort if needed.

DISSOLVE TO:

We watch the crew member being rescued and the helicopter departs the frame. (stock)

MEDICAL 11
(voice over)
The DDMS is able to locate crews in the ocean in less than 3 hrs and rescue them in less than 6 hrs if they are within a 200 mile area. The crew are rescued, evaluated by the DOD physicians and PJ's and taken to the appropriate medical facility.

DISSOLVE TO:

Front view of the OHF with an ambulance in front of it.

MEDICAL 11
(voice over)
The crew can also be returned to Kennedy Space Center where they can be taken to the Occupational Health Facility, the Baseline Data Collection Facility or a triage site as deemed appropriate by the DOD surgeon and the EMS.

CUT TO:

Medical 11 in raft, looking worried.

MEDICAL 11
I hope they get here soon...

FADE OUT.

ACT 3: THE CLOSING

Closing sequence

55 EXT. HELICOPTER FLIES OUT OF FRAME 55

Music plays. We watch a rescue helicopter fly across the frame.

NARRATOR
Every launch from Kennedy Space Center has its inherent dangers. The extraordinary risk requires careful planning for an immediate and effective response to any emergency.

We watch quick dissolves of the various team members in action.

NARRATOR
As long as spaceflight remains a complex and hazardous endeavor, there is a great need for the medical expertise of the aerospace medical specialists and the support personnel who provide care during each mission.

NARRATOR
This will be critical when Kennedy Space Center becomes a fully operational commercial spaceport in the near future.

NARRATOR
The Gateway to the Universe is well guarded by the medical professionals at Kennedy Space Center, The guardians of the gateway.

56 EXT. AERIAL VIEW OF KSC 56

We see KSC from a bird's eye view. A beautiful juxtaposition of nature and high technology. Adventurous music

FADE OUT.

57 CLOSING CREDITS 57

Credits roll

FADE IN

We see a faint background of the aerial shots of KSC. Adventurous music continues.

Credits: List of Cast and Crew

References: KSC EMS Procedure Manual

Contact Info: Bionetics Medical Office Mail Code Bio-1
Kennedy Space Center, Florida, 32899

END