

ILM - "MARS ATTACKS!"

"Mars Attacks!" was initially planned as a stop-motion project, much like director Tim Burton's earlier work "Nightmare Before Christmas." But this time the animated characters would need to exist in the real world with the likes of Jack Nicholson, Sarah Jessica Parker and Pierce Brosnan among others. The plan was for ILM to composite the 15" armatured Martian puppets over various live-action plates. Meanwhile, technical hurdles kept popping up for the stop-motion unit, so I pursued doing a test of Martians which would be completely built and animated inside a computer. The test was successful and showed Tim that computer animation, and the array of digital tools we had to offer, would be the most effective way to blend his Martians into the live-action. Most importantly, it presented computer animation as viable a method as any other for creating complex character animations.

In a little over 8 months, we created 304 visual effects shots, including 246 with 3D Martian character animation. Crucial to the work at all phases was the believability of the Martian personalities, their actions and the result of those actions. A team of over 100 artists worked together to bring Tim's strange imagery to life. Certainly, a project like this requires the talents of many. Collaborating with Mike Fink and Michael Lantieri helped us to achieve the needed continuity in the character of the film.

LOCATION WORK

In the 3 months of principle photography, we shot VistaVision plates alongside the first unit production crew. Crucial to the integration of the CG Martians into the live-action plates was the comprehensive measurements of all the sets, props and camera positions. To help the actors visualize where the Martians would be, we employed "stand-ins" similar in size to the Martians. They were dressed in crude versions of their space suits, so we were able to use them as reference for lighting our CG versions. All plates used were shot clean (no "stand-ins"), requiring the fabrication of all interactive shadows and reflections. No motion control equipment was used on location.

MARTIAN MODELS

Altogether, 7 different models of the Martian characters were built. The first version was the "nude" Martian clad only in red bikini briefs. All models were sculpted free-hand in the computer with fine detail, such as brain convolutions and skin roughness painted as displacement textures to be applied in rendering. This initial model was then clothed and modified to create other versions. For example, a sequined cape was draped around the neck and shoulders of the ambassador and leaders that we see on the spaceship. The cape presented our first technical challenge because of the tricky nature of simulating cloth and the complex look of

the material. For movement of the cape we steered clear of the often computer-intensive and unpredictable dynamics software, and instead favored a more hands-on approach. Although time-consuming, it would be in keeping with the way all the characters would be animated. We wrote new software that added sculpting tools to our in-house shape animation program "Caricature." This enabled the animator to clean-up and contour detailed shapes on top of the keyframed positions. In addition, to give the characters their regal appearance, a special cape shader was written to make it sparkle and shimmer as it moved throughout the environment.

The second set of Martian models were those in green space suits. Shaders were designed to create the different parts made of rubber, hard plastic, burnished metal and, of course, the glass helmets. Special care was taken to simulate the refractive quality one would expect from such a curved transparent surface. To do this we used rendering techniques to bend the background plate that the Martians were composited into. Additional detail included scratches and smudges which interacted with the lighting, much as it would in real life. It was also important to "dirty-up" the suits and take the clean CG look away.

Over 80 more CG models were built to support the Martian conquest including: rayguns, a helicopter, the Taj Mahal, surgical tools, a dove, giant robot, grandma-blaster, human and dog skeletons and a Playboy magazine.

MARTIANS ON EARTH

One of the biggest issues to resolve was the look of the ray blasts coming from the Martians' guns. In keeping with the low-tech design, established as an homage to the sci-fi flicks of the 50's, we decided on the look of a pulsing electrical beam that would glow either green or red. Since this effect would need to work in many shots, we decided to stay away from using a particle system software and opted for another approach. We attached a long, thin cylinder to the end of the raygun and designed a fractal noise shader that would displace it into various squiggly patterns. This element was then enhanced in the compositing stage where a glow and hot core were added.

To achieve the effect of the Martian's head exploding, there were a couple of techniques. In the case of the green goo splattering on the wall in the White House, a particle system was required to blow blobby elements out of the brain, and onto the wall, where gravity would cause them to drip down. When the Martian heads explode in their helmets, animated texture maps of the dripping green blood were rendered on the inside of the transparent surface.

MARTIAN GIRL

Unlike the other Martians that were fully modeled and animated in the computer, this Martian, in the form of a shapely blonde, was a hybrid. Because a prosthetic mask could not be made to fully replicate the skulled features of our Martian, it was decided to attach a CG Martian head to the body of actress Lisa Marie. This was more difficult than just animating a complete Martian because we first had to erase the actress' head. We did this without using a motion control camera to record a matching clean background. Instead, the assistant cameraman would try to duplicate the dolly pan and tilt moves, as close as possible, to what he had done on the selected take. Both shots were scanned and our 2D artists painted away the live-action head frame-by-frame, grabbing the correctly lined-up parts of the clean plate.

This was not a typical matchmove as it was critical to also define, in 3D space, where the actress was on the set. To do this we constructed a low-res model of the actress' upper body and used it to track her live-action body movements. The animators could then add the head movements and facial expressions to the Martian head, which was parented to the low-res body. A CG version of the dress collar was also used to fill in the back of the actual collar, hidden by the actress' larger neck.

Finally, the green Martian blood that spews from the Martian girl's brain (when shot) was animated with a particle system set to emit from points on the head.

MARTIANS IN THEIR SPACESHIP

All the spaceship interiors, including a command center, operating room and robot port, were shot using a 25 ft., quarter-scale model constructed on our motion control stage. The set stood 18 ft. high and had many different props and Martian apparatus built by our model shop to reflect the 50's retro design. Items such as the steering columns in the command center and many of the light fixtures were also hooked up to the motion control computer so the CG Martians could interact with them later. Most other items that the Martians come in contact with were built as CG models and painted to match the look of the rest of the ship. Initially we blocked out the camera move with low-res CG animatics in the computer. The actual shots were then filmed in VistaVision and scanned into the computer. One advantage we gained during production was a program, written by our software team, that took our Kuper motion control data and converted it into a CG camera move. This program saved considerable time by eliminating the tedious process of hand-tracking a camera move in the computer, and it is now in use on other productions.

The orb (or Martian television set) was one prop that took special consideration. Sometimes it was a physical model with a white light pulsing inside. But whenever the Martians were watching an image playing back, such as the video from the Martian girl's ring, the entire unit was a CG model. We created our glass globe using a modified version of the helmet material so that it would catch reflections of the spaceship walls and the Martians standing beside it. Underneath the glass, a square patch was distorted over the sphere to represent the viewing area of the

image. The video or film to be played back was then texture-mapped and rendered frame-by-frame onto the surface. Glitches and vertical roll were accomplished in the shader by procedural noise techniques.

MARTIAN EXPERIMENTS

Here we and the Martians got to be a little like Dr. Frankenstein, cutting and sewing together body parts in creation of some of the most bizarre images of the film. These sequences required the densest layering of elements of any of the shots we produced. In most cases we shot the plates of the quarter-scale operating room backgrounds before shooting the bluescreen elements of Pierce Brosnan and Sarah Jessica Parker. We then took the camera information such as height, tilt and lens, and figured out their relation to the full-scale bluescreen stage.

Again, everything was shot in VistaVision. For the sequence where Sarah Jessica's head is seen in a glass jar, we wanted to make her look like she was floating in some sort of liquid so we over-cranked the camera at 96 fps. This gave her hair a more fluid action when played back at 24 fps. After extracting the bluescreen image, we used articulated garbage mattes to stencil away the neck and shoulders. These images were then texture-mapped to a patch that was parented inside the computer model of the glass jar. To keep the image from skewing, due to the perspective change as the Martian walks away from the camera, we constrained the surface to always be parallel to the camera plane. The advantage was that Sarah Jessica's head inherited all the movements of the jar being carried by the Martian, plus it always stayed oriented toward the camera. The set of bubbles you see surrounding the head were animated texture maps, while the bubbles coming from her mouth when she screams were actual 3D spheres controlled by Dynamation.

The only time we shot any of the bluescreen elements with motion control was the shot where the camera trucks along with the Martian as it walks up to Sarah Jessica, sitting in a chair surrounded by the surgeons. First, we filmed the move through the quarter-scale model. Then a few weeks later, on a different stage, we plugged the motion file into our portable field unit. The data was then scaled to reflect the full-scale environment, thus duplicating the original move on the actress in the life-size chair. Synching the two elements up assured the chair would register to the same spot on the miniature set. The Martian surgeons were then composited on top of this new background.

In the scene where the Chihuahua's head is put onto Sarah Jessica's body, the plates were shot locked-off, which allowed us to use 2D techniques to bring the two elements together. We started by stabilizing the bluescreen plate of the barking dog so that its neck would remain fairly stationary. Prior to filming, we painted registration marks on Sarah Jessica's neck at the point where the dog's head would be attached. We tracked these marks in the computer to create a 2D move and applied it to the extracted dog's head. With the head following the neck, we then

covered up the seam between them by tracking 2D artwork of stitches pulling the fur and human skin together.

The 2D method, however, was abandoned for the opposite effect when we placed Sarah Jessica's head on top of the dog's body. I decided we should animate a CG version of the Chihuahua as it would give us more control over the emotions and actions that Tim wanted, and shooting the dog bluescreen in this instance would be too unpredictable. Using photos of Poppy the dog, we sculpted a replica and fastened a CG version of Sarah Jessica's neck. The model required a fairly detailed 3D paint job of human skin and fake fur. Attaching Sarah Jessica's head was done in a similar fashion to how we rendered her head in the jar. At the end of the dog's neck, we parented a card that would move with the dog and also face the camera at all times. On this card we rendered the footage of Sarah Jessica talking. Part of the character animator's responsibility was to ensure that the CG human neck was oriented the same way as the live-action neck, so that we could make a soft blend between the two.

BURNING COWS AND SKELETON EFFECTS

Both the scene with burning cows (dubbed "the barbecue sequence"), and the shots where the Martians vaporize their victims with their rayguns, made extensive use of our enhanced version of the Dynamation particle system.

We first tracked each of the 80 cows with a CG representation which looked something like a large saddle riding along the cows back. Random points along this surface were then defined as points of emission for our flame effect. Many iterations of tests were required to establish the rules necessary for controlling and creating the fire. As with many of the effects in "Mars Attacks!," we were aiming for the surrealistic by design and the burning cows were no exception. Color saturation was pushed to achieve a somewhat unworldly look for realistic smoke and fire.

This was also the case with the red and green skeletons revealed when blasted by Martians. Unlike the cows, the surface where the particles (fire) are emitted was actually animated along the three dimensional contours of the victim. In this way, the flames could start at a certain point, then work out to the tips of the hands and head. We then used articulated mattes to follow along these paths and expose a skeleton with a clean background composited behind. Over twenty shots were done this way, but with a twist on the technique to keep them unique.