

## Sentinels of the Heliosphere

By Lori Keeseey

Greg Shirah isn't holding his breath, but a new 20-minute visualization that he and his team created to show the dance of NASA's heliophysics satellites could be considered for an Academy Award nomination.

SIGGRAPH 2009, an international conference and exhibition on computer graphics and interactive techniques, will present "Sentinels of the Heliosphere" as one of the world's 135 most innovative and stimulating computer-generated animated films at its Computer Animation Festival in New Orleans.

The festival's "Best in Show" award qualifies the winner to be considered for nomination in the Academy of Motion Picture Arts and Sciences Best Animated Short Film category.

Though winning the Best in Show award would be nice, and an Oscar even better, Shirah is pragmatic. He's pleased that "Sentinels" made the cut in the first place, especially considering the caliber of films submitted for inclusion in the festival. "Most of the movers and shakers in the computer graphics industry are there," Shirah said, referring to the bevy of animators, including Hollywood types, who attend the event each year.



Caption: The team behind "Sentinels of the Heliosphere." Left to right: Tom Bridgman, Ernie Wright, Greg Shirah, Horace Mitchell.

Making the recognition even sweeter, Shirah will be presenting at the show the techniques that Goddard's Scientific Visualization Studio (SVS) used to create "Sentinels," which tours the regions of near-Earth orbit, Earth's magnetosphere, the expanse between Earth and the Sun, and out beyond Pluto where *Voyager 1* and *2* are exploring the boundary between the Sun and the rest of the Milky Way.

This isn't the first time SVS has presented a film at SIGGRAPH. The studio, which works closely with scientists to create products that promote a greater understanding of Earth and space science, also will present a stereoscopic version of its "Safe Landing Sites" animation at this year's event. In addition, Helen-Nicole Kostis, another SVS staff member, plans to give a talk on stereoscopic visualization.

Shirah concedes that there's a lot of data in "Sentinels," including the orbits of 25 spacecraft, 8 planets, Pluto, and the Moon. "What we wanted to show was how many satellites we have out there, how big the Sun's influence really is, and how NASA's trying to study these gigantic structures."

Shirah believes the film achieves those objectives, and does this without compromising scientific accuracy. Most everything—including the position of the background stars as Earth makes its journey around the Sun and the relative size of its protective magnetic shield—is accurate. As the camera zooms in for a close-up of Earth, viewers can even see moving clouds and the line that separates day and night as the planet rotates on its axis. "What isn't accurate, of course, is the size of the Moon, the planets, and the spacecraft," Shirah said. "We had to scale them so that they could be seen."

Also accurate is how the team depicted the satellites' varying orbits, including the paths of two spacecraft that make up NASA's *Solar Terrestrial Relations Observatory*. When the Agency launched the spacecraft in 2006, they initially flew in a tight, highly elliptical orbit around Earth. As the film shows, the two started pulling away from one another after performing a "bank shot" off the Moon. While one continued traveling away from the Earth-Moon system towards its final orbit, the other intercepted the Moon's orbit a second time to execute a rollercoaster-like maneuver that then propelled it farther out into space.

As the film points out, sometimes travel isn't the goal. To achieve a certain scientific objective, the satellite needs to "park" near one of the so-called Lagrange points—where the gravitational pull of two objects balances one another. NASA's *Solar Heliospheric Observatory* is one such spacecraft. Parked in a halo orbit along Lagrange Point 1, the animation shows the observatory's location between the Sun and Earth and its unobstructed view that allows it to study solar activity in unprecedented detail.

The film even shows the far-flung orbits of *Voyager 1* and *2*, which are now investigating a vast region at the edge of our solar system where solar wind runs up against the thin gas between stars.

"We're really pleased with the results," Shirah said. "We've never shown the dance of heliophysics spacecraft like this before. What we hope is that people will look at this and appreciate the sheer number of satellites patrolling the heliosphere and the amazingly complex paths they take to carry out their jobs."

But he concedes he isn't quite finished with the project. He wants to add an animated overlay showing a coronal mass ejection, a balloon-shaped burst of solar wind that sweeps over Earth a few days after it explodes from the Sun's corona, frequently resulting in strong geomagnetic storms, auroras, and electrical power blackouts. "Sentinels' is a great first step," he said.

To see the film online, visit: <http://svs.gsfc.nasa.gov/goto?3595>. ■