BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

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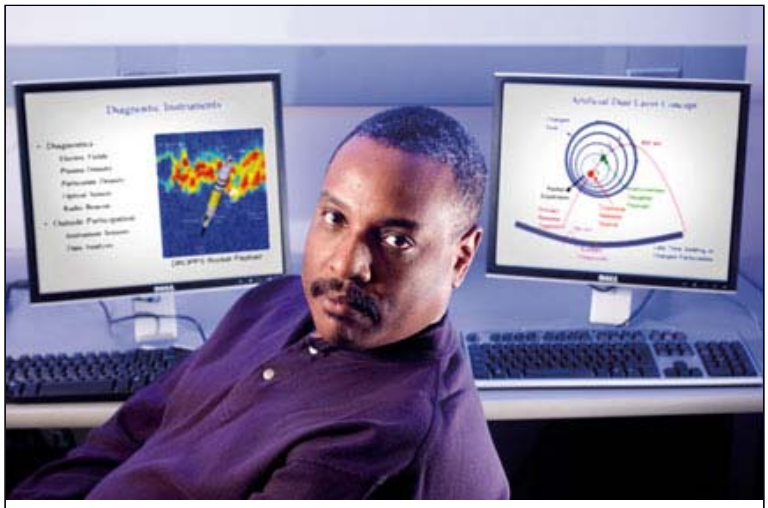
Special Feature: SPACE WEATHER

Creating Waves



Wayne Scales, director of the new Center for Space Science and Engineering Research

Being an expert in computational space plasma physics has involved Wayne Scales in projects from analyzing the effects of high-altitude nuclear detonations to creating and perturbing charged dust clouds in space.

In a multi-university effort funded by the Department of Defense, Scales and Joseph Wang, an aerospace professor, are developing a model to mitigate the impact of the earth's radiation belts on space assets. "This is part of a multi-university effort to counteract a high-altitude nuclear detonation (HAND). Such a detonation won't affect the people on earth, but the radioactive particles are predicted to destroy the electronics on spacecraft and basically wipe out most of the low-earth orbiting satellites in about a week," he says.

The project's goal is to develop novel techniques of generating electromagnetic waves that interact with the radioactive particles and scatters them out of the radiation belt, he says. "One way to do that is to use a big, high-power transmitter on the ground that sends a high power radio wave. Another option would be to use a satellite that has a high-power transmitter, he says."

The Virginia Tech team is involved in a third option: using a spacecraft that ejects chemicals that photo-ionize and create electromagnetic waves which then interact with the radioactive particles to scatter them out of the radiation belts. Scales' and Wang's model addresses the effects within seven days of a high altitude detonation. "We're trying to determine what is the most efficient and quickest way to counteract this threat. How much chemical do we dump? How much wave energy do we need to create for

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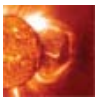

Satellite Navigation

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SuperDARN It's Raining Plasma

the scattering to be effective? If we dump a certain amount of chemicals, how much wave energy will be involved?"

Another project in space computation involves noctilucent clouds that form at the edge of space, shine at dusk, and are believed to be related to global climate change. Over the past several years, the team has developed a comprehensive computation model for investigating the interaction of high power radio waves on these charged clouds for diagnostic purposes.

"We've gone as far as we can with the theory; now we want to do experiments to validate our theory;" Scales says. The team is building a radar receiver to use in Alaska at the high frequency active auroral research program (HAARP) facilities

The team not only studies natural clouds, but is involved in a Naval Research Laboratory project to create an artificial noctilucent cloud. Called the charged aerosol release experiment (CARE), the project entails sending a sounding rocket from Wallops Island, Va., to create a large dust cloud over the East Coast.

The Virginia Tech team will be involved in developing a theoretical and computational model to study the turbulence generated in the charged dust cloud. "Radars will be used to bounce signals off the dust cloud to see if the turbulence, which is linked to global change, is the same as a natural noctilucent cloud," Scales says. The sounding rocket project principal investigator is Paul Bernhardt of the Naval Research Laboratory. "We're working to see if the new Blackstone SuperDARN radar will be able to contribute to the project as well."

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