

# Speaking With Objects of our Profession

## An interview with NASA's TERRA Satellite

In 1999, the US National Aeronautics and Space Administration (NASA) launched the first satellite of its Earth Observation System (EOS). Dubbed "TERRA," this satellite, with a projected life span of 15 years, was specifically designed to provide a comprehensive monitoring of a host of important dynamics in the Earth's systems, including land cover change, estimates of primary productivity, a basis for climate forecasts, assessments of natural hazards such as earthquakes, and detection of changes in land use. Each day, with its five sensor instruments, often referred to by their acronyms of MODIS, ASTER, CERES, MISR, and MOPITT, the TERRA satellite passes over the same points above the earth in its pole-to-pole orbits, providing terabytes of data from near daily global coverage of sensed radiations. These data streams are analyzed by dozens of teams of scientists in a wide diversity of disciplines, and those analyses have contributed greatly to new understandings of our planet and its diverse biophysical processes. See <http://earthobservatory.nasa.gov/> for a further discussion of TERRA and EOS. Since TERRA's launch, NASA has added additional satellites to the EOS array. For a glimpse of future missions to replace obsolete satellites see <http://www.nasa.gov/centers/goddard/missions/future.html>. It is assumed these planned missions will survive vagaries of federal bureaucracies and funding priorities. This fictitious interview occurred early in 2010 as TERRA entered the last years of its amazingly productive life span.

### Dispassionate Observers

*Question: What function are you providing those of us here on the surface of Earth?*

*Answer:* I'll answer that in a minute, but I need to first make sure I'm safe while we communicate.

*Excuse me? You are in danger at the moment?*

Obviously, you haven't been up here. The amount of junk and debris orbiting the planet is a real concern to those of us in outer space just above the atmosphere trying to do our jobs. Just last year, two of my fellow satellites collided. In addition, recent estimates are that there are 17,000 pieces of debris of various sizes floating around the Earth. You've

had to implement a space surveillance network in an effort to keep track of all of this orbiting junk.

*Isn't a collision between satellites quite unusual?*

It never has happened before. The official explanation was that given the number of satellites now in orbit, a collision was inevitable. The unofficial explanation, however, was that the Russian satellite was "out of control."



The TERRA satellite containing five sensors prelaunch in 1999 as the first of NASA's Earth Observation System (NASA Photograph #KSC-99PP-1413; credit: NASA Kennedy Space Center).

### *Orbiting under the influence?*

It only is a rumor that there might be vodka aboard the space station. The truth is, however, that a select group of humans are in control, not us. They launch us into orbit, we circulate until we expire and then we either burn up as our orbits degrade into the atmosphere or we are detonated to then spend an eternity as 4-inch-plus pieces of debris. It's not very glamorous, and it's getting increasingly congested, even in orbits approaching 500 miles above the Earth's surface. And, on my dark side, it is  $-454^{\circ}\text{F}$ .

### *But you can't complain about the views.*

They are stunning, and they are the reason we are so functional in these orbiting positions.

### *So, speaking of functions...?*

OK, I seem to have a clear path of orbit ahead, so back to your opening question. I am several tons of orbiting material, in daily orbits oriented around the Earth's poles at an elevation that allows my sensors to observe the entire planet each day. I am one of 15 satellites that make up NASA's EOS. First launched in 1999, each of us was placed in orbit to detect trends in changes within the Earth's systems. Pure and simple, we are dispassionate observers.

### *There is nothing dispassionate here on Earth in the debates that result from our interpretations of your observations.*

You debate everything from the existence of God to the nature of your own origins. You never seem to agree on much of anything. The only way you seem to have agreed to move past a debate is to arrive at some score, some tally, on one side or the other of a topic. Higher score, more votes, greater influence wins. Everything is a game. That is the competitive dimension of your nature. We constantly monitor these dimensions because other satellites are now the primary conduits of your debates, and quite possibly every one of your articulated thoughts, no matter how narrow, obtuse, perverse, and ill-conceived. The flow of information from cellular telephones alone through my companion communication satellites is nearly unimaginable now, and that is just while you're driving your automobiles!

### *What is it, though, that you specifically observe?*

I was launched in 1999 and carry an array of sensors that are essentially radiometers. These are devices that measure electromagnetic radiation, which includes the same kind of electromagnetic waves used in microwaves, radios, televisions, and visible light. My sensors are set up to detect radiation within spectral bands that can tell you about dynamics of atmospheric temperatures, snow cover, ocean surface topography, cloud properties, and stratospheric chemistry, among dozens of other measurements that reflect conditions on earth. Some satellite sensors detect natural

radiation; others also detect reflections of radiation they emit. My sensors, and the interpretations of the data they supply, are a product of a massive, coordinated scientific effort that is unprecedented and ongoing. Although I am nearing the end of my life span, more recently launched satellites are used to further refine the sensors I carry and expand on our observations. Anyone engaged in serious debates about the interpretations of these observations needs to be acutely aware of the scientific validity of these data. We have never been able to gather these types and extents of data about the planet before.

### *And these data are a basis for many of our observations of recent changes in earth's systems?*

Yes. My sensors detect changes in radiation. Granted, teams of scientists have chosen what to detect, and how those data are analyzed, but these sensors are unbiased sources of data to the extent of our engineered capacities.

### *And what other functions are being provided by satellites?*

Understand that about 10 countries around the planet are launching satellites, and are conducting missions for an additional 40 countries or so. At any one time, there are hundreds of satellites in orbit, and they are providing a multitude of functions well beyond my role in observing clouds, oceans, and landscapes. Think about it—your children are online nearly every waking moment. We can instantly monitor countless elements of your environment, and we even guide your movements. The more proper question might be “What functions are not being provided?”

### *Although it is not as if you can observe what I am doing right now.*

I see you are outside of your home drinking from what appears to be a martini glass, and your attire reflects a rather pathetic wardrobe.

### *Sorry, but I know you do not have the capability to make these observations at this fine a scale, although you have guessed correctly on both counts.*

You are correct. As an instrument of NASA's EOS, I do not have that capacity.

It is some of the other satellites.

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*Interview conducted, edited, and condensed by Susan R. McGuire, a pen name used by the author of this article. Her “interviews” with members of our profession, inanimate objects, biological specimens, and other subjects of passing interest are an irregular contribution to Rangelands. All costs of publishing these interviews are sponsored by a research unit of the Agricultural Research Service, the in-house research agency of the United States Department of Agriculture, whose rangeland scientists are a segment of the Society for Range Management.*