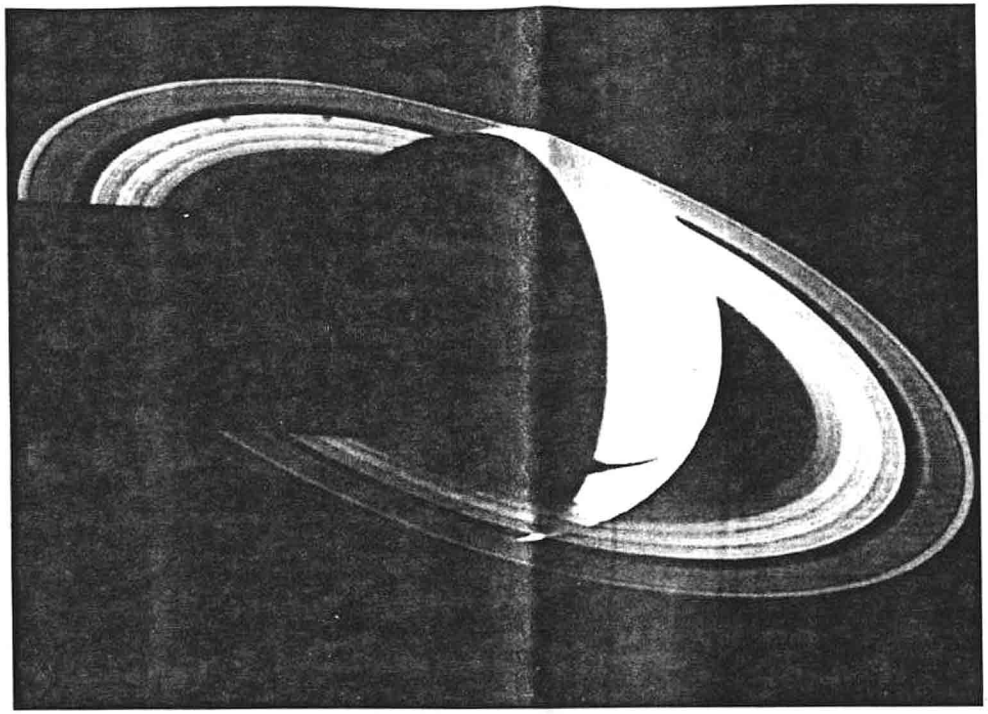
VIEWPOINTS

Guest Comment

Extensive scientific scrutiny tells us Cassini is safe

By Carolyn C. Porco



While humankind stands poised to catapult its most ambitious spacecraft yet into the maw of interplanetary space, a lively debate is underway on TV, on radio and in print.

The Cassini spacecraft has been designed and built jointly by the National Aeronautics and Space Administration and the European Space Agency to take the next step in our explorations of Saturn, a planet offering mystery, scientific insight and splendor beyond compare. The spacecraft will lift off from Cape Canaveral in mid-October carrying 72 pounds of radioactive plutonium-bearing material to power its scientific instruments and the engineering systems that support them.

Plutonium emits high-energy helium nuclei at such a rate that its heat output is prodigious. The marshmallow-sized pellets of plutonium dioxide carried by Cassini reach a surface temperature of about 2,300 degrees Fahrenheit in space, and that heat is converted into the electrical power needed by the spacecraft's components in radioisotope thermoelectric generators.

Why the fuss? Opponents of the Cassini mission are claiming that an accidental atmospheric re-entry during Cassini's gravity-assist 800-kilometers fly-by of Earth in August 1999, in which the spacecraft and its nuclear material could be incinerated, will spread enough plutonium around the world to have dire global consequences.

NASA and the manufacturers of the radioisotope thermoelectric generators, the Department of Energy, disagree with their opponents on how probable an accident is, on what the consequences of such an accident would be, on the moral integrity of NASA in its use of radioactive materials in space, and even on what constitutes dangerous. The public is left having to trust one side or the other.

Unfortunately in our culture, where even critical discussions seem constructed around 15-second sound bytes, many of the subtleties in these arguments are being entirely lost on the listening and reading public.

How can an alert citizen steer a clear path through the maze of conflicting assertions?

For guidance, one might turn to the discipline of science itself. In seeking acceptance of any new idea, a scientist is required to offer up the details of her investigation and the supporting evidence to a community of peers for scrutiny and validation.

This time-honored practice has elevated to the status of natural law such spectacularly counter-intuitive ideas as Albert Einstein's theory of relativity and has taken down such eagerly awaited but irreproducible findings as cold fusion. This is the very practice by which NASA and the Department of Energy have conducted their analyses of the dangers associated with Cassini's nuclear payload.

Following a standard procedure mandated for every mission carrying nuclear material into space, NASA and the Department of Energy submitted their environmental and safety reports to the Interagency Nuclear Safety Review Panel for detailed scrutiny. This panel is populated, not by "swamis and mystics," but by representatives of the Department of Energy, NASA, the Department of Defense and the Environmental Protection Agency. The Nuclear Regulatory Council is also invited to attend.

Furthermore, upward of 50 scientists, engineers and risk analysts from universities, private consulting firms, private industries and government labs supported the Interagency Nuclear Safety Review Panel in its evaluation.

For Cassini, an additional review team headed by Massachusetts Institute of Technology's Lincoln Labs independently examined the analyses of probability, risk and possible outcomes of a re-entry accident.

When both launch and re-entry scenarios were considered in detail — accounting for expected values of shock pressure and temperature during a launch accident, the details of atmospheric circulation, fallout of dust, population density in Southern Florida and around the globe, etc. — NASA and the Department of Energy concluded that Cassini presents 20 times less exposure to any individual human over the course of 50 years than does a single dental X-ray and about 15,000 times less exposure than we each receive from natural background radiation arising from the earth, the atmosphere, cosmic rays and our own skeleton.

And the extensive reviews conducted by Interagency Nuclear Safety Review Panel and MIT have affirmed these conclusions: Cassini is a safe enterprise.

In marked contrast, the closest the opposing side has come to offering a critical analysis for evaluation is a piece appearing on the Internet by nuclear physicist Michio Kaku, "A Scientific Critique of the Accident Risks from the Cassini Space Mission." This document is riddled with flaws — ad hominem attacks, technical statements that are not supported by scientific analysis and statements designed to generate indignation like: "Even if no significant amounts of radiation are released in a plutonium accident at launch, property values are expected to plummet."

However, it's most glaring weakness is its lack of scientific peer review, making it not a scientific critique at all but an editorial.

In any debate over an issue as significant as this one, it is obligatory for both sides to present the evidence and methodologies supporting their findings in clear sober language for all to examine.

Despite the sound-byte wars and expert testimonials and anecdotes presented to the public by the media within the past few months, a careful look behind the scenes shows that NASA and the Department of Energy have won the argument handsomely. They have followed to the letter the method of scientific analysis and critique that has taken humankind from Galileo's first experiments with gravitation all the way to Neptune and beyond, and they have laid their results bare and accessible for other experts to evaluate in detail. There is no better testimonial in science than that.

It is my belief that the Cassini plutonium debate — despite its necessarily superficial treatment in the media — is, at heart, a fruitful one. It has engaged the citizens of Earth, openly, in a question that needs always to be kept front and center: Are those in whose hands we have entrusted such powerful and enabling technologies also safeguarding our health and our planet?

Until we are satisfied that the answer is yes, it is our right and, more so, our duty to remain doubtful, to ask questions and demand answers.

I believe that the concerns and questions of individuals who are genuinely in search of answers are not only meritorious in their own right, but play an important role in the sound intellectual development of our citizenry.

And to these seekers of answers, I will say this. When evaluating the personal dangers presented by technologies that propel human progress, both on the ground and in space, it is worthwhile to take a broad dispassionate look at the facts. In our country alone, roughly 42,000 people die in automobile accidents every year. That's not a prediction, that's a fact.

In comparison, the anticipated outcome of a highly unlikely Cassini atmospheric re-entry has been estimated to be 120 possible deaths over 50 years. That's not a fact, that's a prediction. Statistically speaking, it is possible for no deaths to occur whatsoever.

Is even one human death desirable? Of course not. Can we challenge the Department of Energy to make radioisotope thermoelectric generators even safer? Certainly.

But in the same interest of saving human lives, objectivity and just plain common sense, should we not, then, also challenge the automobile industry to ensure the complete safety of its vehicles — vehicles that we mindlessly enter day in and day out?

If safeguarding human life is really the point, it would seem far wiser to direct one's energies at technologies proven to be deadly, rather than those that have been predicted to be safe. And the facts show: Cassini is safer than a trip to the dentist.

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