Space Nuclear Power Public and Stakeholder Risk Communication*

Sandra Dawson
Jet Propulsion Laboratory
4800 Oak Grove Dr. Pasadena, CA 91109
Tel: (818)354-1240, Email: sandra.m.dawson@jpl.nasa.gov

Maria Sklar
The Aerospace Corporation
200 S. Los Robles, Suite 150
Pasadena, CA 91101
Tel: (626)395-0458, Email: maria.e.sklar@aero.org

Abstract – *The 1986 Challenger accident coupled with the Chernobyl nuclear reactor accident increased public concern about the safety of spacecraft using nuclear technology. While three nuclear powered spacecraft had been launched before 1986 with little public interest, future nuclear powered missions would see significantly more public concern and require NASA to increase its efforts to communicate mission risks to the public. In 1987 a separate risk communication area within the Launch Approval Planning Group of the Jet Propulsion Laboratory was created to address public concern about the health, environmental, and safety risks of NASA missions. The lessons learned from the risk communication strategies developed for the nuclear powered Galileo, Ulysses, and Cassini missions are reviewed in this paper and recommendations are given as to how these lessons can be applied to future NASA missions that may use nuclear power systems and other potentially controversial NASA missions.*

I. INTRODUCTION

The public was not concerned with or was unaware of the use of nuclear power systems onboard NASA missions before the 1986 Challenger accident. The nuclear powered Viking, Pioneer, and Voyager spacecraft launched with little public concern, and there was little note of the RTG-powered science package on the Apollo missions. The launch of Galileo in 1989, however, with its two radioisotope thermoelectric generators (RTGs), met with more Congressional, media, and public criticism and opposition than all previous missions combined.[1] Galileo was also the subject of the first lawsuit to stop the launch of a NASA mission.[2] The launch of Cassini in 1997 was preceded by significant media attention, a coordinated opposition effort that resulted in thousands of opposition letters and phone calls to the White House and Congress, and demonstrations.[3] Some members of Congress went on record opposing Cassini and/or sent letters to the White House asking for a mission delay pending development of a new power source,[3] and many communities across the country passed anti-Cassini resolutions.[4,5] A lawsuit was filed to delay the mission days before launch.[6]

In 1987, to address public concern about the potential environmental, safety, and health risks of NASA missions, a separate risk communication area within the Launch Approval Planning Group at the Jet Propulsion Laboratory (JPL) evolved.[a] Through the years, the JPL risk communication staff has developed successful risk communication strategies for missions such as Galileo, Ulysses, and Cassini. The goal of risk communication is to earn and maintain the public's confidence in NASA's commitment to honestly communicate mission risks and in its ability to manage risks. Education and outreach programs provide the public with knowledge of engineering and science, but aren't sufficient to alleviate public concerns about mission safety. A continuous process of communicating information in an open and inclusive environment and in a manner that is meaningful to the public is required. In such an environment the processes of mission selection, design, and operation are communicated to the public, and viewpoints outside

[a] At the time this effort was known as 'external communication', since the field of risk communication was still fairly new and not used within NASA.

* This research was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautical Space Administration.

NASA are given meaningful consideration. JPL's risk communication efforts through the years, together with the lessons learned, provide a foundation on which risk communication efforts for proposed future nuclear-powered missions can be built.

II. GALILEO AND ULYSSES

The Galileo and Ulysses missions were the first missions for which a risk communication strategy was developed. The Galileo mission to Jupiter was launched onboard the space shuttle Atlantis in October 1989. The Ulysses mission to explore the northern and southern regions of the sun was launched a year later in October 1990 onboard the space shuttle Discovery. Once in orbit around Earth, both missions were launched into the solar system from the shuttle cargo bays by an inertial upper stage (IUS) rocket. To gain enough velocity to reach Jupiter, Galileo followed a Venus-Earth-Earth Gravity Assist (VEEGA) trajectory, traveling in toward the sun for a gravity assist from Venus before swinging by Earth two times (spaced 2 years apart). To get above the sun, Ulysses had to fly around Jupiter and slingshot out of the plane of the planets. The distant destination of the Galileo mission required two radioisotope thermoelectric generators (RTGs) onboard for electrical power. The single RTG onboard the Ulysses mission was required to provide spacecraft power during the trajectory that Ulysses followed to achieve its polar orbit about the sun.

II.A. Galileo And Ulysses Mission Risks

Each RTG onboard Galileo and Ulysses contained 24 lbs of plutonium **dioxide**, the majority of which was **Plutonium**-238, a non-weapons grade form. Radiological risk assessments were done by the Department of Energy for each mission and presented in the missions' Environmental Impact Statements. For both the Galileo and Ulysses missions the estimated probability of release of the plutonium dioxide was greatest during the inertial upper stage deployment of the spacecraft from the shuttle cargo bay.[7,8] Failure of the inertial upper stage could have led the spacecraft to break up, causing their RTGs to reenter Earth's atmosphere, where they could potentially have impacted hard rock and released a small amount of plutonium dioxide. The probability of the inertial upper stage failure leading to release of plutonium dioxide was estimated to be about 1 in 2,500 for Galileo[7] and about 1 in 4,670 for Ulysses.[8] In both cases, however, such an accident would have resulted in no additional cancer fatalities above those normally expected in the exposed population over a 50-year period.

The highly unlikely reentry of Galileo during its flyby of Earth was considered the highest consequence accident. Under this accident scenario heating from reentry could have caused the RTGs to release their graphite impact shells containing plutonium dioxide. In the mission's nuclear safety analysis, three of the graphite impact shells were estimated to hit hard rock and release plutonium dioxide. The probability of the flyby accident leading to release of plutonium dioxide was estimated to be about 1 in 9 million.[7] and was estimated to potentially result in an average of nearly 10 additional cancer fatalities above those normally expected in the exposed population over a 50-year period.

The highest consequence accident scenario for the Ulysses mission involved the highly unlikely high speed impact of its RTG by a shuttle solid rocket booster fragment, which would have resulted in release of plutonium dioxide high in the stratosphere. The probability of this accident leading to release of plutonium dioxide was estimated to be 1 in 44 million and was estimated to potentially result in an average of 15 additional cancer fatalities above those normally expected in the exposed population over a 50-year period.[8]

II.B. Galileo And Ulysses Public Risk Perception

Both missions had been scheduled to launch in May, just months after the Challenger accident on January 28, 1986. The accident prompted the public, Congress, the media, and other stakeholders to question whether launching nuclear payloads onboard space shuttles was wise.[9] Democratic State Representative Edward Markey of Massachusetts, who was investigating the risks of future shuttle missions carrying nuclear systems, asked the Department of Energy to release its initial risk analysis of the Galileo and Ulysses mission launches to the public. The report estimated the Galileo and Ulysses missions could result in an average of between 40 to 43 cancer deaths over 50 years from a pre-launch phase accident or from an accident during the first few seconds of flight.[10] The most-probable accident and worst-case accident scenarios, not included in the initial analysis, were calculated on Markey's request. These cancer figures were higher. The most probable pre-launch accident scenario was estimated to result in 202 cancer deaths and the worst case 386.[11]

Driving the higher casualty figures was the use of a previously untried Centaur liquid hydrogen rocket to launch the spacecrafts out of the shuttle cargo bay.[12] The higher shuttle accident probability estimates, coupled with the high volatility of the Centaur rocket fuel, drove NASA to scrap plans for using the Centaur rockets months after the shuttle accident.[13] An inertial upper stage solid rocket was chosen instead. A year after the Challenger accident, the Galileo mission draft environmental impact statement, which included the change to the inertial upper stage

rocket and new results from RTG testing, demonstrated that the launch risks were now sufficiently low to proceed with the mission.[14]

Despite the lower risks and additional internal and external reviews of mission safety assessments, opposition groups remained skeptical and untrusting of NASA's ability to safely launch a nuclear payload. One of the most vocal of the organizations opposing launching the missions was The Florida Coalition for Peace and Justice. It published a brochure referring to Galileo as a ''bomb pointed at Earth.''[1] The brochure claimed that, ''While we might survive the Galileo or even the Ulysses missions, we clearly understand that it only takes one Challenger-type explosion at launch or one Chernobyl accident in space to destroy life on our fragile planet.'' They, along with other groups, held protests at the Kennedy Space Center and in front of the White House.

The Christic Institute, a public interest law firm, and several other organizations requested a temporary restraining order to halt the Galileo launch.[2] It was the first legal case ever brought against a civilian space mission. The lawsuit cited among its reasons for seeking a restraining order, "the very poor record NASA has of estimating risks" and "the reliability of the shuttle itself."[15] The court concluded that it was not its function to decide whether launching Galileo was a good decision, but to examine whether NASA violated the National Environmental Policy Act by filing an insufficient environmental impact statement. The court found NASA had complied with NEPA and the case was dismissed.

As Galileo got closer to launch, activists ranging from Florida-based environmentalists to the West German Green Party vowed to infiltrate the Kennedy Space Center and stop the shuttle.[16] Guards stood ready to confront about 40 protesters, of whom eight were arrested while attempting to push past guards. Although Galileo was launched without incident, the protests continued through to the Ulysses launch and were restarted when Galileo swung by Earth en route to its destination.

II.C. Galileo And Ulysses Risk Communication Effort

The risk communication effort for the Galileo and Ulysses missions was aimed at countering the misinformation about the risks of the missions with consistent, accessible, and coordinated radiological risk information. The effort involved NASA; NASA centers such as Kennedy Space Center (KSC), Johnson Space Center (JSC), and JPL; the Department of Energy; the German Space Agency; and the various industry and academic partners.

A number of lessons came out of this first full effort in risk communication for a NASA space nuclear mission. The first lesson learned was that it was important to have mission risk information ready and available very early in the mission, before any opposition arose. The importance of the information being accurate, easy to understand, and responsive to the public's concerns was critical. Another key was the need for early coordination with all key players, and having the key spokespersons for a project identified and trained to effectively communicate with the public. Since space project scientists and engineers mostly talk to each other when discussing technical details of space nuclear missions, it takes specific training for them to be able to communicate with those who do not have technical backgrounds. The importance of having an agreed-upon process in place to respond quickly to issues and concerns was the third critical lesson learned, and was essential when the number of letters and concerns increased.

III. CASSINI

The Cassini Mission to Saturn, a joint NASA-European Space Agency (ESA) and Italian Space Agency (ASI) mission to study the planet and its rings, moons, and magnetic environment, was launched on October 17, 1997 onboard a Titan IV/SRMU/Centaur launch vehicle. Cassini required three RTGs to operate its vast array of scientific instruments at Saturn. The 72 lbs of plutonium dioxide of the three RTGS was the most plutonium dioxide ever launched by NASA. To reach Saturn in 6.7 years, Cassini followed a VVEJGA (Venus-Venus-Earth-Jupiter Gravity Assist) trajectory, requiring risk assessment of plutonium dioxide release during both launch and the Earth swingby.

III.A. Cassini Mission Risks

The models predicated the highest probability accident resulting in release of plutonium dioxide occurring during the late launch portion of the mission. The probability of release during this stage of the mission was estimated to be about 1 in 476 and would have resulted in no excess latent cancer fatalities.[17,18] The highest consequence accident involved Earth reentry of Cassini during its Earth swingby. The probability of this accident occurring with plutonium dioxide release was about or 1 in 1,250,000. Although highly unlikely, had this accident occurred it could have resulted in 120 worldwide cancer fatalities over a 50-year period.

III.B. Cassini Public Risk Perception

As mentioned earlier, there was more evidence of opposition to Cassini than to the previous missions, and much of this increased opposition was due to the

Internet.[19] An organized letter campaign over the Internet resulted in more letters to Congress and the White House.

There was more media coverage of the space nuclear aspects of the mission, and of the controversy surrounding it.[b] The CBS and CNN web sites had informational Cassini pages,[20] and there were stories on "60 Minutes", "Good Morning America,"[21,22] numerous Florida television stations, and on national radio shows. There were a number of organizations who made available extensive information on the mission. Information was available in the publications and on the web sites of the American Institute of Aeronautics and Astronautics, the Planetary Society, the Skeptics Society, the Institute of Electrical and Electronics Engineers, among others The increase in Congressional letters led to the petition against Cassini by some Congress members, and politicians as far-flung as Marin County, California and Baltimore, Maryland debated and/or took positions in opposition to the mission.[19]

III.C. Cassini Risk Communication Effort

However, the previously mentioned lessons learned were brought to bear, and extensive coordinated planning was done prior to the mission. NASA, including Lewis Research Center, KSC, and JPL, DOE, Lockheed Martin, and the European Space Agency were included in the planning and implementation of a broad risk communication plan. The elements of this plan were: the continuation of the Galileo/Ulysses process of developing timely, accurate, accessible information, with the addition of having this information posted on the Internet; more proactive media interaction, including making key project personnel available for interviews and editorial boards; expanded training of designated spokespersons; briefing of all project personnel on risk communication issues; development and implementation of a process to respond quickly to letters from the public to NASA, Congress and the White House; and identification of independent outside experts who could be referred to the media in response to requests for experts to provide counterpoints.

This risk communication effort was successful in getting the Cassini project's story on the risks and benefits of the mission widely disseminated. A number of newspapers did extensive stories on the mission, but they were, for the most part, balanced and accurate.[23] By the time of the launch, in October 1997, most editorials discussing the mission were positive. The television and radio stories also presented the issues fairly accurately.

However, even with this relative success, NASA recognized that, as the general consensus in the risk communication field was discovering and propounding, the model of risk communication that had government agencies making decisions then concentrating on their presentation of decisions needed revision. During this period, risk communication had evolved from studies of how to best disseminate information to theories on how to advance understanding and cooperation through multi-party dialogue.[24] NASA media relations, risk communication, and project personnel recognized that potentially controversial future missions would need earlier, more proactive public involvement.

IV. MARS EXPLORATION PROGRAM

In the mid-1990s excitement over the Mars program grew, as planetary scientists and astrobiologists began searching for signs of past or present water on Mars with plans that might lead to a mission that would bring Mars surface samples to Earth. NASA responded by developing an ambitious agenda for the Mars Exploration Program that includes orbiters, rovers, and a sample return mission. The mix of landers, rovers and orbiters and their science instrument payloads are designed to answer questions about how geologic, climatic, and other processes have shaped Mars and whether life could exist there now or in the past. The scientific objectives of each mission are developed in response to the discoveries of the last. Some of the future planned missions are expected to require nuclear power systems and/or return samples to Earth.

IV.A. Mars Risk Communication Workshops

Anticipating possible controversy in using nuclear power systems for Mars exploration and in a Mars sample return mission, NASA recognized the benefit in expanding the risk communication efforts into the area of true public involvement. A Mars risk communication strategy workshop at the NASA Wallops Island Facility in September 2001 began the internal discussion regarding the inclusion of early public dialogue in all future mission risk communication strategies. The Keystone Center, a non-profit public policy and educational organization, was hired by JPL to coordinate and direct the workshop, which was attended by personnel from the NASA Mars Program, NASA Public Affairs, Planetary Protection, and National Environmental Policy Act (NEPA) Compliance offices, along with personnel from JPL, JSC, and the Department of Energy. Workshop participants discussed

---

[b] A Nexis/Lexis search on stories on Galileo, Ulysses and Cassini that mention the RTGs turns up about 500 articles on Galileo, with less than ten before the Challenger accident, and only two of those mentioning it as a public concern. Until Challenger, For Ulysses the number was about 230. The Cassini coverage began in 1989, with over 900 stories, 740 of them in the year prior to launch. Most of the stories in the year prior to launch mentioned the controversy.

the advantages and challenges of including other agencies, informed interest groups, and members of the public in discussions related to the risks and benefits of various missions. The discussions resulted in a set of consensus risk communication goals and guiding principles relevant to not only the Mars Exploration Program, but to any mission using space nuclear power or heat sources. These goals and principles are further substantiated by several decades of risk communication studies.[24]

IV.B. Risk Communication Goals and Principles

The goals developed by the Mars risk communication workshop group that will be applied to future missions powered by space nuclear power are:

- Earn and maintain the public's confidence;
- Identify and respond to a mosaic of diverse "publics, " each with its own specific concerns, needs, and interests; and
- Ensure that clear, accurate, timely, and consistent information is readily available.

In addition to these broad risk communication goals, the group also developed a consensus set of principles to guide the risk communication planning and implementation.

Principle 1: Be transparent:

- Be honest, candid, and open;
- Make information available and easily accessible, as early as possible;
- Use plain language;
- Ensure the transparency to the public of the process by which missions are chosen, designed and operated;
- Ensure that communications channels to the public easily provide information about safety, mission objectives and benefits, programmatic changes, successes and failures.

Principle 2: Be inclusive:

- Seek as many perspectives as possible;
- Be sensitive to cultural differences.

Principle 3: Be interactive

- Listen respectfully and respond constructively to colleagues, critics, and supporters;
- Be clear in establishing where NASA can and is willing to accept input;
- Based on input, be open to modifications or new options

A follow-up to this meeting was held at Keystone, Colorado in 2003, and included NASA Nuclear Systems Initiative (Prometheus) personnel. This meeting reaffirmed the goals and principles, and continued the coordinated planning to meet these goals, for all NASA missions that involved space nuclear power or sample returns.

IV.C. Risk Communication Consultants

NASA, for the first time, engaged consultants from the risk communication field to conduct studies and focus groups on public issues of concern and to provide advice to the Mars program and other programs or projects. One study looked to recently developed biosafety laboratories for lessons for a NASA sample receiving facility.[25] Several other studies used focus groups to look at public concerns around a Mars sample return mission.[26,27,28] The Keystone Center continued its ongoing work on stakeholder involvement for the Mars Program and for other program involving possible space nuclear powered missions.[29]

Other studies were done on the Galileo[30] and Cassini[19] risk communication efforts and on the opposition, many of which were useful in developing the 'lessons learned' and in planning for future missions.

V. RISK COMMUNICATION FOR FUTURE SPACE MISSIONS

Future NASA missions with higher power requirements or to more harsh environments may require nuclear power systems and/or have a sample return as a component of the mission. Risk communication for these and other future NASA missions will use lessons from the experience of prior missions and combine these with new plans for public involvement. The approach of engaging in open dialogue with stakeholders is expected to lead to better and more collaborative missions.

V.A. Issues of Concern

Future missions will likely generate many of the same concerns as past missions. Mission safety and accident risks will likely continue to dominate all future risk communication. Future missions, however, may pose some interesting new risk communication challenges. The larger scope and complexity of some future missions could involve a larger number and greater diversity of U.S. and foreign partners, leading to a much broader risk communication coordination and planning effort. Nuclear technologies developed for some future space missions may be perceived by some as having military applications. Future sample return missions could

generate concerns about possible contamination of planet Earth. Open dialogue about these issues and other possible issues of concerns will be carried out with members of the concerned public and other stakeholders.

V.B. Concerned Public and Stakeholders

All Federal agencies, including NASA, recognize the need to engage the public in discussions of potentially controversial projects. Among 'the public' are a number of people who could be identified as stakeholders. Of course, in a broad sense, all taxpayers are 'stakeholders' in all government-sponsored activities. However, NASA is working to identify and involve those stakeholders who have an interest or identified specific stake in NASA missions. This includes, of course, Congress and the White House, other Federal and state agencies with some participation in NASA missions, the space science community, environmental groups that have concerns or interests in risks and benefits of NASA missions, educators who use NASA materials in the classroom or elsewhere, the media, tribal nations, community groups, and the people who could be most affected by a problem with a NASA mission, such as those living near the launch or testing sites or near a sample-receiving facility. NASA recognizes the stake all of these individuals and groups have, and is seeking to engage them in planning for the future.

V.C. Risk Communication Strategy

Risk communication strategy for the future will be based on lessons from the past, input from experts in the fields of risk communication and public involvement, and from discussions with stakeholders. It will be a comprehensive and process-driven strategy that will be coordinated across programs and missions. A key component of our strategy in the future will be expanded public and stakeholder involvement.

VI. CONCLUSIONS

Public and stakeholder concerns about NASA missions have increased since the mid-80s. Fortunately, the field of risk communication has also made tremendous strides since that time. Many of those involved in the Galileo, Ulysses, and Cassini risk communication efforts are leading the risk communication efforts for NASA's missions today. The risk communication process and the external products have been improved using lessons from past missions and lessons on risk communication from other agencies and organizations. The strategy is now more proactive, and more focused on early public and stakeholder involvement. Working in partnership with the public and with identified stakeholders, we hope to continue to improve our work, and eventually move toward a model that includes more collaborative and responsive decisionmaking.[31]

ACKNOWLEDGMENTS

The authors would like to thank Beverly Cook, Mary Beth Murrill, and Paul VanDamme of JPL, and Janesse Brewer of The Keystone Center for their careful review and valuable input.

REFERENCES

1. THERESA M. FOLEY, "NASA Prepares for Protests Over Nuclear System Launch on Shuttle in October," Aviation Week & Space Technology, Vol. 130, No. 26; Pg. 83.

2. WILLIAM J. BROAD, "Groups Sue to Stop Shuttle Flight Because of Radioactive Payload," New York Times, September 29, 1989.

3. "Is it safe or not?; Monday's Cassini launch has created... PLUTONIUM PANDEMONIUM," Florida Times-Union, National/International; Pg. A-1, October 11, 1997

4. MARK SILVA, "Plutonium Rocket Ignites Conflict," The Post and Courier (Charleston, SC), Section: A, Pg. 7, October 3, 1997.

5. "Carrboro Resolution Opposes NASA Plutonium Use," Chapel Hill Herald, Inside Front; Pg. 16, October 12, 1997.

6. BRUCE DUNFORD, "Opponents Try To Halt Cassini," Associated Press, Domestic, non-Washington, general news item, October 14, 1997.

7. National Aeronautics and Space Administration, "Final Environmental Impact Statement for the Galileo Mission," May 1989.

8. National Aeronautics and Space Administration, "Final Environmental Impact Statement for the Ulysses Mission," June 1990.

9. H. JOSEF HEBERT, "Questions Raised About Launching Spaceships with Nuclear Payloads," Associated Press, February 19, 1986.

10. ELIOT BRENNER, "Study estimates plutonium risks from shuttle blast," United Press International, March 18, 1986

11. "Accident In Atomic-Powered Satellite Launch Could Cause 202 Cancer Deaths," The Associated Press May 19, 1986.

12. PHILIP M. BOFFEY, "Nuclear Reactor Hazard Is New Concern In Shuttle Flights," New York Times, Section C; Page 1, Column 1; Science Desk, March 18, 1986

13. KATHY SAWYER, "NASA Junks Rocket Plan Because of Safety Concerns," Washington Post, First Section; A1, June 20, 1986.

14. "Space agency readies environmental statement," United Press International, November 23, 1987.

15. HARRY F. ROSENTHAL, "Bush Expected to Approve Launch of Nuclear-Powered Probe," Associated Press, September 12, 1989

16. JAMES COATES, "Antinuclear activists vow to halt shuttle launch," Chicago Tribune, NEWS; Pg. 5; ZONE: C, October 17, 1989.

17. National Aeronautics and Space Administration, "Final Environmental Impact Statement for the Cassini Mission," June 1995.

18. National Aeronautics and Space Administration, "Supplemental Environmental Impact Statement for the Cassini Mission," June 1997.

19. CHRISTINE M. RODRIGUE, "Internet Media in Technological Risk Amplification: Plutonium on Board the Cassini-Huygens Spacecraft," *RISK: Health, Safety and Environment*, Vol. 12, *¾(Fall 2001)*, 221-254.

20. KIRK LAPOINTE, "Cassini has its own space on Web: Leisurely 11-year stroll to Saturn will be well-documented on the Internet," The Gazette (Montreal, Quebec), The Web Page; Pg. D11, October 22, 1997.

21. 60 Minutes, CBS, "What is Cassini? It's a rocket about to be launched that carries 72 pounds of plutonium. Why are scientists so concerned? We'll tell you tonight.," October 5, 1997.

22. "Failure Could Expose Thousands To Plutonium," Good Morning America, American Broadcasting Corporation, September 9, 1997.

23. ROBYN SURIANO and TODD HALVORSON, "Cassini: Debating the Risks," Florida Today Newspaper, September 14, 1997

24. PETER ADLER and JEREMY L. KRANOWITZ, "A Primer on Perceptions of Risk, Risk Communication and Building Trust," Keystone Center (keystone.org), February 2005.

25. RAGNAR E. LÖFSTEDT, "Good and bad Examples of siting and building biosafety level 4 laboratories: a study of Winnipeg, Galveston and Etobicoke" *Journal of Hazardous Materials*, Vol. 39, Issue 1, pages 47-66, July 1, 2002.

26. M.S. RACE and D.G. MACGREGOR, "Integrating Public Perspectives in Sample Return Planning," *Adv. In Space Research*,. Vol. 26 (12), 1901-09. (2000).

27. D.L. MACGREGOR and P. SLOVIC, "What Society Members Think About Planetary Protection," *Planetary Report*, Vol. XV(2), p. 4-6, March/April 1995.

28. M.S. RACE, "Anticipating the Reaction: Public Concerns about Sample Return Missions," *Planetary Report*, XIV(4), p. 20-22.

29. PETER S. ADLER and JANESSE BREWER, "Project Prometheus Stakeholder Interviews Findings And Recommendations," The Keystone Center (keystone.org), June 2004.

30. MICHAEL MAHARIK and BARUCH FISCHHOFF, "Public View of Using Nuclear Energy Sources in Space Missions," *Space Policy*, 9, 99-108, May 1993.

31. TODD A. BRYAN, "Tragedy Averted: The Promise of Collaboration," Society and Natural Resources, Vol. 17, p. 881-896, (2004).