

## **Appendix A**

### **A Summary of an Extant Study of the Risk Perception of Nuclear Technologies for Space Exploration**

*There has been only one study published on the public perception of risks of space nuclear power technologies. What follows here is a discussion of that study.*

In 1992, Baruch Fischhoff and Michael Maharik analyzed the public perception of risk from nuclear energy sources after the disputed 1989 Galileo launch. An example of knowledge theory, the study was an analysis of risk communication practices and predicted that, as most people learn more, their concerns about the technology are reduced (Maharik and Fischhoff, 1992). The authors characterized public protest regarding space nuclear power as dependent on the quality of the information received by the social actor.

Contextualist in nature, this study attempted to qualify not only what the respondents believed about the technology, but also their beliefs prior to receiving information about nuclear power technologies for space exploration. Their methodology used the mental models approach and compared an expert model of the risks from the launch of a nuclear power supply to laypeople's mental models (Thompson and Rayner 1998). Experts on space nuclear power systems were asked to map out the particular technical risks associated with these technologies—these technical risks are the same elements that are included in NASA's usual risk assessment methodology. Then through interviews, the mental models of respondents were mapped onto this expert model and the numbers and correctness of correlations (as compared to the baseline or expert model) were tabulated.

Maharik and Fischhoff discovered that the majority of respondents had a nonspecific mental model and opposed the use of space nuclear power because of an *a priori* bias against nuclear

technologies in general. As these individuals were members of the local Pittsburgh Audubon Society, with a stated antipathy to nuclear power, it may not be surprising that their concerns were unchanged after receiving technical information. This conclusion is supported by Thompson and Rayner (1998). Also unsurprising was the high degree of understanding of the respondents to the technical risks from an SNP launch, as was revealed in the interviews with Audubon members who were largely professional and college-educated. The conclusion drawn in the study was that, given the pattern of strengths demonstrated by the respondents, risk communication should be better detailed to clear up incorrect or mis-applied information, to fill significant gaps in knowledge, with tighter relational structures between concepts, and to dismiss unrelated concepts. The authors conclude that "knowing more about what experts believe should help laypeople identify courses of action in their own—and their society's—best interests" (Maharik and Fischhoff, 1992, p. 391). This conclusion is opposite that of Mackenzie who posits that confidence will not necessarily increase with additional information, only with additional identification with the technology in question (Jasanoff, after Mackenzie, 1998).

In a related article, in the journal *Space Policy*, the authors presented additional information. In this case they noted that "the more that they know, the more favorable they are—unless they have prejudged the issue (either favorably or unfavorably)" (Maharik and Fischhoff, 1993, P. 107). This is an oversimplification that ignores issues regarding trust, liability, and consent; the cultural identification of the respondents; and the possible linkages between SNP technologies, disarmament, and nuclear energy issues. The authors showed that the highest rate of respondents' unconditional acceptance for the use of SNP was for unmanned interplanetary missions. The respondents were not willing to accept the risk from nuclear technologies on behalf of humans traveling to other planets and they rejected the use of SNP for human interplanetary missions. The chief area of concern for respondents was from the launch of the mission and an uncontrolled re-entry from orbit. The respondents judged the launch to offer the most significant technical risk, while judging an uncontrolled re-entry from orbit as having the most significant consequence. These responses indicate that trust in NASA was a significant issue, a point ignored by the authors. The educational process that the respondents went through did not change their opinion of the technology, it merely increased their understanding of the risks. As

will be seen in this thesis, merely increasing the public's technical knowledge will not address the essential cause of the controversy.

Maharik and Fischhoff's conclusions were based on the notion that members of the Pittsburgh Audubon Society are representative of the wider global population, that the experts are correct in their technical estimations, and that there are no value systems in question in the controversy (Thompson and Rayner 1998). If the lessons learned from this example of knowledge-based theory were applied to the STOP CASSINI! campaign, it would teach NASA to present the facts better, and to do as much as possible to communicate the "real story," as determined by the experts, to concerned citizens.

In fact, NASA held public interest meetings in which it presented its risk assessment and environmental impact statements for the Cassini mission to the media and the public (NASA 1997). For example, the Brevard County Planning Commission held public hearings in which citizens had the opportunity to question NASA representatives. The Jet Propulsion Laboratory developed a pamphlet and posted risk information onto its webpage. NASA's educational campaign was a success, for all the local governments—whose constituencies are largely made up of NASA and military personnel—accepted the launch and published supporting statements. However, during my lengthy conversation with Mr. Bruce Gagnon, leader of the STOP CASSINI! campaign, it was clear that he had a detailed, well-understood mental model of the technical risks and opportunities presented by SNP, one that closely matched Maharik and Fischhoff's expert model. His point of view against SNP was never challenged by new facts. Such an observation would tend to falsify knowledge based theory as a means of reducing risk perception.

If NASA chooses to employ this theory as a framework for reducing public protest, then it is placing its confidence in a narrowly conceived communication channel. By narrowly conceived, I mean that NASA will determine, based on its own expert model, what facts the public should know, where the public's understanding is inadequate, and what the public's response should be. NASA will also need to face several other issues in its information campaigns, for example (Thompson and Rayner 1998, page 272):

- "The relationship between what people say in opinion surveys and what they actually do is tenuous, and the studies cannot act as accurate predictors of how the respondents will really behave;
- Policymakers tend to perceive the public as being concerned primarily with their economic situation
- Some decisionmakers hold the view that technology will solve [the resulting] environmental problems
- Policymakers who propose a technological fix as the answer to [the risk presented by space nuclear power technologies]."

Specifically, if NASA uses knowledge based theory as it has been applied in the past, then it is endorsing the view that the public should speak when spoken to, that the public has a role in choosing policies but not in designing their content, and that the public has no right to reflect before answering (Fischhoff 1996). In the example provided by Maharik and Fischhoff, a knowledgeable information policy would increase the public perception of risk of a humans-to-Mars exploration program, because increased information will do nothing to decrease the risk perception from frequent launches of nuclear materials. NASA must develop some other robust policy that will focus not only on information and understanding, but also on the contexts within which information is presented, and understanding developed.