NASA

Marshall Space Flight Center
Space Sciences Lab

Communications Contingency Plan: Planning for Crises and Controversy

Phase One

Submitted to the Marshall Space Flight Center, August 1997, by Arla G. Bernstein, Department of Mass Communication, University of Florida.

Foreword

The following Phase One report is based on both an investigation of the principles and practices of crisis communications and a series of interviews conducted during June and July, 1997. Interviews were conducted with a variety of Marshall Space Flight Center personnel and local media representatives in Huntsville, Alabama, in order to identify the current perceptions of these individuals regarding communication effectiveness between MSFC and the media. The purposes of the Phase One report are to (1) assess the need for a contingency plan for communicating in situations of crisis and controversy; (2) identify goals and objectives for the planning process; and (3) provide recommendations for future planning activities to achieve the goals and objectives outlined in Phase One.

It is strongly recommended that MSFC personnel who are involved in communications with the media participate in a facilitated, strategic communications planning process in order to develop Phase Two of the Communications Contingency Plan (CCP). Phase Two will address (1) the categorizing, ranking and prioritizing of crises and controversies; (2) the development of action steps and implementation strategies for the CCP; and (3) the development of a monitoring and evaluation process for ongoing plan effectiveness.

I. Introduction

A contingency is a chance occurrence. To plan for contingencies is to plan for alternative occurrences and outcomes, and for uncertainty. Contingency planning increases the probability of positive outcomes in negative or less than optimum circumstances; therefore, contingency planning is a judicious and visionary business activity for any organization. For an organization such as NASA's Marshall Space Flight Center, whose activities have major national and international consequences, contingency planning has critical public implications. To plan for a crisis is a major step in "managing image under siege" (Gottschalk 1993).

Two major types of organizational contingencies are crises and controversies. Crises and controversies occur in all organizations, including NASA's Marshall Space Flight Center. A *crisis* is a major occurrence with a potentially negative outcome affecting an organization, as well as its publics, products, services or reputation (Fearn-Banks 1996). It interrupts normal operations and can sometimes threaten the existence of an organization. *Controversy* is a disagreement or debate regarding an issue or phenomenon. Science, in essence, is controversy. It is an adversary proceeding, in which each scientist does his or her best to find support for a particular view and points to flaws in the work of others, unless and until the evidence shows that another explanation is superior. Given the focus of MSFC on scientific research, there are many opportunities for controversial issues and events. Frequently, controversies regarding scientific research conducted by MSFC attract public attention and concern. These concerns should be of paramount importance to MSFC, a public agency supported by public funding.

Given the public nature of crises and controversies involving MSFC, communication with the public regarding these events plays a crucial role in resolving them in a manner which has positive consequencies for the agency. Research indicates that organizations with ongoing two-way communications can either avoid crises or endure crises having shorter duration or of lesser magnitude (Fearn-Banks 1996). *Crisis communication* is the communication between an organization and its publics prior to, during, and after the negative occurrence. "The essential role of crisis communications is to affect the public opinion process and to be instrumental in establishing and communicating proof that the prevailing 'truth' is not factual or not wholly factual" (Fearn-Banks 1996: 9). The communications should be designed to minimize (1) damage to the reputation and credibility of the organization; and (2) loss of support to the organization from its publics.

The news media is a primary tool for influencing public opinion. Knowing when and how to call a news conference, when and how to do one-on-one interviews, and when and how to disseminate written material are critical components of crisis and controversy management. However, crisis communications are not merely these activities. Frequently, ongoing community relations and stakeholder relations are involved. Stakeholders are people who are linked to an organization or have an interest in an organization and are affected by managerial decisions of the organization. An organization that encourages and supports crisis communications planning will suffer less perceptual (and financial) damage than the organization that does not.

The practice of crisis communications should be viewed as a long-term process rather than a series of short-term response patterns following specific disasters. This process involves a combination of planning-prevention, issues management, crisis management, and postcrisis management (Gonzalez-Herrero and Pratt 1996). The purpose of a well-planned crisis communications strategy is to build and nurture positive relationships with an organization's publics before a crisis erupts. A proactive, ethical approach to crisis communications is the most effective means of building and maintaining a reputation as a socially responsible organization.

The development of a communications contingency plan to handle crises and controversies is a critical activity for communicating effectively during such occurrences and for facilitating the overall management of a crisis or controversy. The steps needed to develop such a plan include the following:

(1) identification of goals and objectives of the plan;

(2) preparing an historical profile of significant crises and controversies;

(3) preparing an inventory of the types of crises and controversies that can occur;

(4) ranking and prioritizing crises and controversies according to type, vulnerability, probability, and severity;

(5) establishing a "crisis/controversy communications team"; and

(6) outlining the action steps needed for crisis/controversy communication management.

By identifying and analyzing past and potential crises, an organization can provide the information needed to develop a comprehensive system of crisis communications management. It is important to realize that contingency planning is an ongoing, dynamic process, not a static one. There is no end-state plan, for as an organization becomes involved in new programs and its operations occur in a changing social and political environment, evaluation and updating of the plan is vital for its effectiveness.

II. Goals and Objectives for Crisis and Controversy Communications

Goals and objectives establish the direction for a course of action. An organization must know where it wants to go before it can determine the ways by which it will get there. *Goals* are long-range, visionary and broad statements of **what** an organization wants to accomplish, and *objectives* are specific statements of **how** the organization plans to accomplish its goals.

Goals

The Marshall Space Flight Center has three major goals for its Communications Contingency Plan:

(1) Communicate promptly and accurately with the agency's various publics or stakeholder groups through effective media relations;

(2) Maintain credibility, accountability, and integrity in the course of its communications management; and

(3) Utilize communications with the media and other strategic publics to facilitate overall management of crises and controversies.

Each of these goals requires a set of objectives to accomplish the stated goal.

Objectives for Goal 1:

Objective (1): Be sensitive to media deadlines for reporting MSFC news.

Objective (2): Disseminate materials to the media in time for the preparation of quality news reporting.

Objectives for Goal 2:

Objective (1): Provide open communication and accurate information to the media.

Objective (2): Establish trust with the media by allowing routine visits between the media and MSFC personnel, including public affairs officers and scientists.

Objectives for Goal 3:

Objective (1): Provide effective communications during crises and controversies, thereby reducing unnecessary stress and distraction to MSFC personnel during difficult and demanding events.

Objective (2): Provide effective communications during both crises and non-crises operations to build public support for NASA and MSFC missions, thereby providing an operating environment more conducive to effective and efficient management of crises and controversies.

Specific strategies for achieving these objectives should be developed in Phase Two of this plan.

III. Profile History of Crises and Controversies

An important first step in the preparation of a Communications Contingency Plan for Crises and Controversies is reviewing and critiquing past crises and controversies that occurred in the organization's history. Describing the past crises confirms the need for a contingency plan, identifies specific problems encountered which need to be addressed, and points to potential crises and controversies in the future. Potential crises and controversies are associated with specific vulnerabilities and risks. Once communication managers identify the potential crises, they can work to correct the underlying causation factors and prepare to manage unavoidable crises. Some crises in operations of the organization can be at least partially mitigated by means of crisis communications management.

Methods for Acquiring Information to Profile Crises and Controversies

In order to gather information about crises and controversies in an organization's past, there are several methods or approaches that can be used: (1) surveys; (2) interviews; and (3) content analysis of existing documents. Surveys can be conducted of employees, managers, and external publics, such as the media, contractors, and the general public. Interviews can be conducted of these same groups. Information can be derived from the content analysis of media clippings and organizational documents on file.

Information regarding past crises and controversies can be organized either by using a case study approach or selecting a specific category of problem to study. An example of a case study would be the Hubble Space Telescope Mission of 1990 or the Columbia MSL-1 Mission of April 1997. An example of a categorical problem would be a study of the effectiveness of press conferences in situations of crisis or controversy. In this study, the case study approach is used, in order to provide a more comprehensive analysis of communications during a time of crisis or controversy.

The "4-Day Columbia MSL-1 Mission" : A Case Study

The 4-day MSL-1 Mission, which was flown on April 4-8, 1997, was a case in point of a situation which required contingency communications. This particular mission had to be shortened from 16 days to four days due to mechanical (fuel cells) problems aboard the shuttle, thereby making it an unusual event in the history of NASA's missions. Due to the abbreviated mission, the agenda of scientific experiments had to be considerably shortened as well. This event is an example of an unusual and difficult event necessitating a "contingency" approach to communications between MSFC personnel and the media.

In order to collect information to profile the "4-day mission," interviews were conducted with both MSFC personnel and local media representatives. The following sections summarize the information derived from interviewing nine personnel, including scientists, public affairs officers, and administrators employed at MSFC, and five media representatives from Huntsville, Alabama newspaper and television companies.

Media Interviews

In June and July of 1997, five Huntsville, Alabama media representatives were interviewed by a researcher from the University of Florida's Department of Mass Communication. The purpose of these interviews was to solicit opinions from the journalists regarding the effectiveness of communication between personnel at the Marshall Space Flight Center and the local media. A case study approach was used, contextualizing many of the questions asked of the media representatives in terms of the events surrounding NASA's Columbia mission of April, 1997. However, it was expressed by the journalists that most of their comments also applied to MSFC-media communications in general.

The overriding message from the interviews conducted is that "NASA needs to tell its story better," both in times of crises and in non-crises. In order for the public to become supportive and enthusiastic about NASA's programs, the public must understand them. Granted, it's a complicated story to tell, but its significance is lost when not told to the media and the general public in understandable, relevant terms.

In order for the media to convey to the public the importance and excitement of what NASA (and MSFC in particular) does, MSFC must describe its missions and its science in a manner which has clarity, accuracy, credibility, relevancy, and sensitivity. And the information must be brought to the media in a timely fashion. These are the key concerns expressed by the media representatives interviewed regarding MSFC's role in helping them to develop quality media reporting. Repeatedly, those interviewed expressed that the level of understandability of much of what MSFC communicates about its science represents opportunity lost, for they all believe in the inherent "grandness" of NASA's science, but are frustrated with the deficiences of MSFC's communicative efforts. This frustration was expressed in comments such as "had to dig to make it understandable to the public;" "it is difficult to find scientists who can explain it to the man on the street;" and "it is hard to understand NASA's explanations."

In addition to the problem of technical language, there is a concern for the lack of explanation of applicability of experiments in a manner which is relevant to the public. Furthermore, one representative expressed the need for more science communication by NASA which "captures the imagination" of the public. For example, visual (graphic) representation of scientific experiments should be designed to excite the public about what NASA does. Another example is targeting specific communications to specific audiences, such as exposing young physicians to the biotechnical advances made through NASA-related scientific endeavors.

Several representatives expressed that they usually get the information they need, but that sometimes there is a time conflict in terms of their deadlines and the schedules of MSFC personnel. In some cases, this is due to the scientists' busy schedules and consequent lack of availability; in some cases, this is due to the PAO's not always being available, such as when they spend time away from their office for training, making speeches, or other duties.

The journalists who were interviewed suggested four specific strategies for improving the problems described:

(1) The scientists at the Marshall Space Flight Center need to be more accessible to the media. The media need to personally spend more time with both the scientists and the public relations officers. They need to get behind the scenes, get more background, learn how the science is done, and get a flavor for what goes on. This would build a bridge of understanding and trust between NASA/Marshall and the media.

(2) NASA's Marshall Space Flight Center needs a designated, full-time liaison who has both a strong science background and strong communication skills who would work with the media, someone who can communicate the science in a manner which is understandable and relevant to the public.

(3) MSFC needs to use more high-quality and effective visual aids to communicate its science in an understandable, interesting, and exciting manner.

(4) MSFC needs to be more proactive about giving advance notice to the media about projects, in order for the media to have more time to develop their stories and verify their accuracy.

All of the problems and strategies discussed by the media representatives are applicable to both "normal" and crisis communications, but are even more critical during crises and controversy. Furthermore, effective crisis communications depend on the quality of communications by MSFC not only during a crisis, but also during the times between them. Building trust and understanding between MSFC and the media requires a long-term, ongoing commitment to communication effectiveness. The organization cannot maintain credibility and good will during a crisis unless the long-term commitment to effective communication exists.

In the interest of ongoing media relations, including both normal and contingency situations, Appendix B contains "Guidelines for Media Contact." These guidelines are intended for personnel whose training is not primarily in the field of communication, but for whom communication of scientific knowledge is important, particularly in situations involving crises or controversy.

Personnel Interviews

In June of 1997, nine personnel members fron MSFC were interviewed regarding personnel-media communications, particularly with regard to the 4-day Columbia Mission. Based on the interviews conducted, several communication problems were identified. The key internal communication problems identified were as follows:

(1) There are coordination problems and philosophical differences among the parties involved in communications during a crisis or contingency situation; and

(2) There is a lack of a designated authority to resolve conflicts regarding (a) communication of crises and other contingencies; and (b) how to respond to the media during these events.

In addition to the problems identified regarding internal communications, employees of MSFC expressed concern about the image that the agency has with the media. While several employees expressed that personnel-media relations have improved recently, there is still considerable concern that personnel are not adequately prepared to handle communications during a crisis or controversy, and the agency's reputation and image suffer accordingly.

Case Study Evaluation

Based on the personnel and media interviews conducted, primarily regarding the "4-day Columbia MSL-1 Mission," it appears that in recent years Marshall Space Flight Center has improved its communications operations during a crisis or controversy, but that additional improvement is needed to consistently achieve its communication goals of promptness, accuracy, credibility, integrity, and accountability. A contingency plan should be a vehicle for making the needed improvements. Given that the case study mission was a midline contingency during which there was no actual life-threatening event, it could be considered a conservative test of what might occur in a future crisis of a more severe nature, such as the Challenger explosion.

In the interest of planning for uncertainty, MSFC communication managers should plan for contingencies of varying severity and risk. This means that communications contingency planning requires planning for "worst case scenarios" as well as less severe contingencies. Contingency communication problems at MSFC are not unique to this particular NASA Center. The NASA agency as a whole has been criticized for inadequate crisis communications and public relations (Chaisson 1994;

Kaufmann 1997). However, MSFC should take a lead in developing a Contingency Communications Plan with the intent of improved communications during crises and controversy.

IV. Identification of Potential Crises and Controversies

A crucial element of crisis planning is identifying areas in which the organization is vulnerable to a crisis (or controversy). A list of potential crises or controversies should be categorized by (1) type or nature of mission or research; (2) preventable/non-preventable; (3) internal/external; (4) vulnerability/probability; (5) severity; and (6) short term/long term.

Some examples of types of crises (situations 1-3) and controversy (situation 4) are:

(1) the Challenger explosion, in which lives were lost in the mission;

(2) the Hubble Space Telescope situation, in which there was a significant equipment problem;

(3) the 4-day Columbia mission, in which the mission was significantly shortened due to an equipment problem; and

(4) the global warming controversy, in which research by different scientists has yielded seemingly irreconcilable results.

As a basis for ranking and prioritizing crises and controversy, other typologies and categorization features will be determined in Phase Two of this plan.

Future Phases of Communications Contingency Planning

In order to complete the Communications Contingency Plan, the following steps need to be accomplished:

(1) Categorizing, ranking and prioritizing of crises and controversies;

(2) Development of Implementation Strategies, including establishment of a Crisis Communications Team (CCT) and preparation of action steps for crisis communications management; and

(3) Development of ongoing monitoring, evaluation, and revision procedures for plan effectiveness.

For example, as part of the ongoing planning process, additional case studies of crises and controversies should be prepared.

Future Planning Activities

In order to address the problem areas identified, including prioritization and mitigation, in this Phase One of the Communications Contingency Plan, the following actions are recommended for Phase Two of the planning process:

(1) Informal meetings between personnel and this researcher in order to gather additional information concerning the existing communication process during contingency situations; and

(2) Use of a facilitated, strategic planning process as a brainstorming and consensus-building activity to address problems and alternative strategies. This should involve

appropriate personnel from all areas of the Center involved in communications of scientific and technical knowledge.

Appendix A

Marshall Space Flight Center
Space Sciences Lab

Communications Contingency Plan:
Planning for Crises and Controversy

Excerpts from the Interviews

External public: MEDIA

1. How well do you think media relations were handled for pre-flight communication?

Excellent, but had to dig to make it understandable to public; difficult to find scientists who can explain it to "man on the street"

explanation of how it fits into broader context of what NASA does: no responses

fair to poor; hard to understand NASA's explanations

2. a. How well do you think media relations were handled during 4-day mission?

During 4-day mission: good, info was out there; Would like more accessibility to scientists

had to dig to make it understandable to public

b. Was the appropriate information getting through to the media during the crisis?

There is a dampening climate for scientists to communicate, but *sometimes media have unrealistic expectations.*

PAO gives me what I need, but sometimes there's a time conflict.

"canned " interviews are one-way; can't talk to scientists

c. Was the on-site media center well organized and efficiently run?

For last mission, press office at 4200 not equipped for crisis--lacked phones, desks; trailers better equipped but only used when national media comes.

Good services—fax, e-mail, Nancy Robinson makes contacts for us

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can do teleconferencing to other centers, but can't get to scientists

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well organized—video, fact sheets, interview set-ups

d. Was the agency (Marshall SFC) sensitive to media deadlines?

PAO has tried to impress on scientists the need to return calls; can't call scientists directly (unwritten rule)

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yeh

3. How could media relations with Marshall personnel be improved?

Media need to spend more time w/scientists; learn how they do their work; get behind the scenes; get background, flavor for what goes on; reduce fear of contact w/media and build trust and understanding between scientists and media.

PAO not always available; spend time away for training, speeches, etc.; there should be someone from PAO available to media at all times; mission press kits have been coming later.

Science missions often doesn't lend itself to easy explanation; scientists/PAO need to simplify language, although somepress releases getting more conversational.

By "telling the story" in understandable way, explaining the significance

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By encouraging stability in media market, encouraging media managers to have long-term journalists covering the complex nature of NASA'science.

Have a liaison w/science background who deals with the media and who communicates the message well.

PAO should be more proactive about letting media know what projects are going on.

PAO should be more proactive about giving media advance notice of what's going on; should even suggest stories.

ff. What criteria would you use to describe a quality media report of a NASA event or project? How about clarity, accuracy, credibility, timely?

yes, and sensitivity to viewer interest.

Agrees, and relevance to viewer.

Yes, and understandable, concise, and relevance.

gg. How can NASA assist the media in developing quality reports?

PAO needs to make personal visits to media to get to know them better, understand where reporter is coming from.

Help reporters "boil it down."

Technology Transfer Office is good at getting the message out, getting media to buy into it. They have unique ability to explain "product value" to the public.

NASA TV could do a regular show like a newsmagazine show w/graphics, music; make it informational and entertaining.
facilitate verification of stories.

Do more to "capture the imagination" by communicating better about applications of the science.

Need more visual aids to increase interest for public.

Internal public: NASA Personnel

1. How well do you think media relations were handled during the "4-day" Columbia mission?

This was another example of PAO not being ready; scientists don't trust the media, have fear of being misquoted; PAO does not have good reputation w/press; defensive w/press. However, there has been some improvement due to communication emphasis of SSL Director.

PAO does pretty good job; supportive of scientists; has improved since Dr. Horack's involvement.

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pretty good job in tough situation

Not involved in 4-day mission, but in Hubble event NASA not truthful; stonewalled media; some scientists wanted emphasis on problems so NASA would fix telescope.

PAO: We have successfully dealt w/contingencies., we've earned credibility; questions are answered by person responsible for issue, as jointly decided by PAO operations.

PAO: Backlash by media due to science community putting "best face" on it, not admitting disappointment; human disappointment of crew not communicated.

b. Was the appropriate information getting through to the media during the crisis?

Yes--PAO works w/scientists in putting out info.

No--alot did but it's tough in 5-10 min. press "thing"; tough to communicate value of basic research

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In Hubble, no; there was a lack of info given to media.

PAO dpendent on info made available by scientists; relationship w/scientists important.

c. Was the on-site media center well organized and efficiently run?

Trailer has some equipment.

d. How could media relations for MFSC be improved?

Need good, strong leadership /one decisionmaker for how to explain an "event."

None--the more press, the less credibility in scientific community (peers suspect of motives).

________ *Need Pre-mission guidance from PAO--need info re personalities of reporters, kinds of questions they might ask.*

Need coordination among flight centers (e.g. Marshall and JSC)--in last mission, Marshall didn't know what JSC was going to tell public until 5-min before broadcast.

________ *PAO relationship w/media needs to be more open and friendly; NASA generally doesn't have good relations w/media. Public relations could be improved through PAO support of scientists being "ambassadors, going out and speaking to public"; increase public's understanding of what NASA does.*

e. Was the on-site central communications center well organized and efficiently run?

Unclear who makes final decision re communication w/media; need to clearly define responsibility for who makes decision re how to respond to media (last mission argument among parties involved in the mission re how to respond).

[Based on interviews of June 5th and 6th and July 9, 1997]

Appendix B

Basic Guidelines for Media Contact

1. Use everyday language, not jargon.

2. Maintain an attitude showing you are calm, courteous, responsive, direct, and truthful.

3. Respect deadlines. Return calls promptly.

4. Be accessible.

5. Try to treat the reporter as a partner, an ally in maintaining or restoring a good image.

6. Tell the truth.

7. Use a technical expert as needed.

8. Do not answer questions you do not understand. Ask for clarification.

9. Make only "on the record" comments. There are no "off the record" statements.

10. Do not play favorites with the media.

11. Do not guess. If you don't know, say you don't know.

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Microgravity Science: An Assessment of Awareness and Understanding Among the Science Attentive Public and Recommendations for Improving Communications

Final Report

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Future of Microgravity Science Outreach Program

It is clear from this investigation that there is a lack of awareness and understanding of microgravity science among science attentive individuals. It is also clear that science attentive individuals use mass media as a source for scientific information, particularly television and the Internet. Therefore, in the opinion of this researcher, NASA must utilize cable and public television along with traditional broadcast outlets to begin its microgravity education campaign. The agency must also continue to maintain its position on the Internet as <u>the</u> source of microgravity science information and promote itself as such. Once the <u>level of awareness</u> of microgravity science has been increased, then the focus of the communication plan can shift to the print media. The print media, whether it be newspapers, general interest magazines, science magazines, science journals, or books, are the communication vehicles necessary for <u>increasing understanding</u> of microgravity science. However, without awareness there will be no understanding.

Microgravity Science: An Assessment of Awareness and Understanding Among the Science Attentive Public and Recommendations for Improving Communications

INTRODUCTION

There is a distressing level of public ignorance about science in general (Ziman, 1991). A survey by Jon Miller of the National Science Board (1990) indicated that most adults do not understand fundamental scientific concepts. Another survey by Northern Illinois University reported one-third of the respondents did not know what a molecule is, two-thirds do not understand what radiation is, and five-sixths do not grasp the basics of genetic engineering. In addition, 57% believe electrons are bigger than atoms, 63% say dinosaurs and humans occupied the earth simultaneously, and 73% think lasers focus on sound waves rather than light waves. Others report that despite an admitted desire for scientific knowledge, the public's level of ignorance is quite alarming (Detjen, 1995). According to James Trefil, a physicist at the University of Virginia, "The general level of scientific knowledge, even among educated people is very low. There are a lot of people who don't know the sun is a star" (Detjen, 1995, p. S-60).

In recent years, the government has turned its attention toward combating the poor level of scientific literacy. President Bill Clinton and Vice President Al Gore (1994), in the foreword of their report, Science in the National Interest, reminded Americans that science helps us solve our problems, learn about life's mysteries, and inspires and enriches us. They called for an investment in scientific research as well as science and mathematics education (Clinton & Gore, 1994). The top executive officers of the United States outlined several goals for science in the national interest:

- Maintain leadership across the frontiers of scientific knowledge
- Enhance connections between fundamental research and national goals
- Stimulate partnerships that promote investments in fundamental science and engineering and effective use of physical, human, and financial resources
- Produce the finest scientists and engineers for the twenty-first century
- Raise scientific and technological literacy of all Americans (Clinton & Gore, 1994, p. 7).

As a federal agency, NASA is among the leaders in promoting the latest advancements in scientific research. The agency has recognized that imbedded in the general lack of scientific knowledge among Americans is a similar ignorance among science attentive individuals with regards to microgravity science. When compared to the other science enterprises within NASA (i.e., space science and earth science), microgravity science is perceived to be at a communicative disadvantage. Members of the "science attentive" public have significantly less background and exposure to microgravity science than to these other areas. Organizations involved in the communication of scientific knowledge require an accurate measurement of the current level of understanding of their audiences so that the most effective communications vehicles can be utilized. Such a measurement in the microgravity science area is required for the Space Sciences Laboratory to better fulfill its requirement to advance and communicate scientific knowledge and understanding, as directed by the NASA Strategic Plan.

This report will discuss the current level of understanding of microgravity science among the science attentive public and provide recommendations for improving communication of microgravity science to raise the level of awareness and understanding of various science attentive audiences.

ASSESSING LEVEL OF UNDERSTANDING

In order to assess the current level of awareness and understanding of microgravity science among the science attentive public a qualitative method of research was employed. Focus groups were used to assess the level of awareness and understanding among a small segment of the science attentive population. These focus group discussions were used to develop a survey (Appendix A), a quantitative method of measurement. Although the survey has not been distributed, it is the principal investigator's belief that the survey will support the findings of the focus group and other relevant literature. Therefore, it is unlikely the recommendations for improving communications of microgravity science would change as a result of the survey findings.

Focus Groups

Demographics

A total of 54 (33 male, 21 female) science attentive individuals discussed their level of awareness, understanding, and interest in microgravity science in six focus groups. Participants included undergraduate and graduate students at a large southeastern university. They ranged in age from 18 to 31 years old. The average age was 22.8 years (males - 23.7 females - 21.3). Backgrounds included nuclear science engineering, electrical engineering, audiology and speech pathology, microbiology, astronomy, medical health physics, telecommunication, public relations, nutrition, psychology, and accounting.

Emerging Themes

Sources of scientific information: Credibility and depth of coverage

Participants described a number of sources of scientific information. However, they noted that some were more credible and some provided greater depth than others.

Among the sources noted were popular magazines (*Popular Science*), newspapers (*Wall Street Journal, Orlando Sentinel*), textbooks, peers, television, science journals (*Scientific American, Nature, Sky and Telescope*), the Internet, and science experts (scientists, professors). Participants rated scientists and scientific journals as more reliable and credible than other sources. However, a single scientist's viewpoint should be scrutinized carefully. Participants suggested that several scientific viewpoints, even though they may be opposing viewpoints, are better than one because an individual is never sure if one scientist has personal motivations for espousing his beliefs and discoveries. Of course, institutional affiliation (e.g., MIT, Stanford, Harvard, NASA) adds to a source's credibility and reliability, especially for the general public.

It was also suggested that certain Internet sites (e.g., NASA's web sites) are useful for corroborating information that is disseminated via other media because the original source of the information maintains the web site. Corroboration is necessary because inaccurate information sometimes filters its way to the general public. Additionally, **participants like the Internet because it provides current information almost instantaneously, where as more respected periodicals take longer to get the information** out.

While the press was cited as a source of information by several participants, one participant explained that most of the items he notices in the press are noteworthy headlines that provide a cursory overview of the subject with little depth. Although, newspapers sometimes provide more in-depth coverage than television news.

Other sources of information included science museums and college classes. Participants suggested that the most common sources of scientific information for the general public are television and newspapers. This is consistent with a recent Roper survey that found that most of what people know about their environment comes via the media, especially television and newspapers (Detjen, 1995).

Lack of knowledge

It was clear that participants possessed a limited knowledge of microgravity science and the MSL-1 mission. Several participants were able to define microgravity in rudimentary terms, i.e., that it refers to an environment that has near-zero gravity. However, only a quarter of the participants were vaguely aware that NASA had launched and completed the re-flight of the MSL-1 mission. Most participants recalled coverage of the Mars Pathfinder landing and the problems aboard the Russian space station Mir. Much of the information these science attentive individuals received was a cursory mention of the mission experiments. One participant said, "Oh, I heard something actually. They were talking about how they were making little tiny fires in space."

Only two or three were aware of the importance of microgravity in terms of conducting experiments. Specific experiments mentioned included ones involving crystal growth, plastics and polymers, semiconductors, and combustion. One participant discussed microgravity's effect on the human body. He explained that in the microgravity environment a lot of blood collects in the chest and reduces leg strength, bones become softer, and there is difficulty maintaining muscle mass. Another participant added that the electrolyte balance is adversely affected in near zero gravity. Participants conceded that the average person's level of awareness/understanding of microgravity science is close to zero.

How to stimulate interest in science

Almost all participants expressed a desire to know more about microgravity science. However, one participant candidly said, "I could live without it [microgravity science information]. It would be interesting, but I'm just saying I could live the rest of my life without ever knowing anything about it, realistically."

An initial problem with promoting microgravity science is the term itself. "It's a big word," said one participant, "you have to get past the initial barrier [the term]. No one's gonna go look it up and find out." Another participant complained that the term microgravity sounds like "something that scientists deal with. It's their part of the world and for all I know that's like some mechanical thing." Still another added, "Oh yeah, it's just that, a word that sounds so abstract and it's so distant and you know it's not like any of us will ever experience it."

Several suggestions were made regarding what would make microgravity science more interesting. The most common suggestion was to make microgravity science more applicable to the average person's life. This might include talking about how different metal and crystal structures could be useful for important new technologies, computers and microchips, or long-term living in space. However, according to one group member, the population may not be able to relate to the type of microgravity experiments being conducted in space.

Appealing to the public's interest is a necessary element in promoting microgravity science, according to several participants. However, there was some discrepancy about how to appeal to their interests. Some suggested promoting the commercial benefits of NASA's microgravity research, i.e., identifying how the average person directly benefits from the discoveries made in the area of microgravity science. Others believed NASA should focus on its more traditional image of "explorer into the unknown" and frame microgravity research in terms of future possibilities like space colonization.

Media outlets tend to run stories that impact people's lives and that have some human interest element, but, in an attempt to provide the public with something to relate to, what often happens is that the science coverage ends up focusing on the people involved rather than the science itself. One participant said that he knew one female astronaut, Shannon Lucid, had been in space for several months, but he did not know what she did while she was up there. "For all I know, she just sat up there and twiddled her thumbs, but she was up there," he said.

"Spectacularized" science

According to members of the focus groups, science needs to be "spectacularized" in order to stimulate interest among the general public. Unless it is wild and wonderful, most people will not pay attention, said one participant. Science offers fascinating discoveries and intriguing possibilities, but most people do not care unless there are pictures of the "science."

While the participants are not representative of the entire science attentive public, their comments do reveal that individuals who are interested in science are not receiving interesting scientific information. A couple of participants commented that the media sets the agenda for the type of scientific information the public considers. Cronholm and Sandell (1981) suggest "the agenda setting function of the mass media may be a useful concept in understanding what role the mass media play in making certain scientific areas and issues salient, and what the consequences are for the contribution and distribution of grants and the recruitment of students and scientists to be" (p. 92). Unfortunately, the agenda setting function of the mass media may hinder the media's ability to thoroughly answer the public's questions about science. Scientific jargon and limited space or time constraints may contribute to the superficial level of scientific information in the media.

Cook, Tyler, Goetz, Gordon, Protess, Leff, and Molotch (1983) applied agenda setting to their experiment involving communication of scientific information. They randomly assigned subjects in Chicago to watch either a report on NBC that exposed fraud in home health care or another program on a different channel. An agenda setting effect was found for NBC viewers; they evaluated health care as an important issue after watching the report. No attitude change was found for those watching different programs.

This filtering function of the media may contribute to the need for spectacularized science. One participant explained that "people like stuff that's shocking and exciting and violent and bloody and sexy, and ... space doesn't have those problems yet."

While there is a need to relate scientific information to the public, there is also a need to create a sense of wonder among the public, said one participant. There was a sense of wonder with the moon landing, with the first few shuttle launches, and the Mars Pathfinder. However, these activities become routine after several missions, and as a result there is no sense of wonder anymore.

Getting the information out: Education is key

Participants had a variety of suggestions for appropriate information outlets. Members of one focus group were adamant about the need for increased education outreach. There needs to be a long-term investment in kids, according to several participants. Children need to have their eyes opened at an early age to the exciting and interesting things going on in the world of science in general. Such exposure can alleviate misperceptions and fears about certain areas of science that are considered more dangerous than others. For example, one participant explained that "the word nuclear alone is a scary word for most people." He believes there are "a lot of things you don't want the general population to know until they have a high enough education level to understand it." Cronholm and Sandell (1981) reviewed a wide range of studies that focused on the dissemination of scientific material and the intended audience and found that "education plays the determining role in both the level of interest and effect among the general public" (p. 85).

One of the more difficult tasks in science education, and microgravity science education specifically, is the need to communicate the idea that science does not always have to justify itself in terms of every penny that is spent, said one participant. Science is a long-term investment, whether it is microgravity science or medical science or physical science. It is also necessary to realize that microgravity science is only a small part of the total science package. As one participant commented, promoting microgravity science is fine for the short-term, but what happens when the general public decides microgravity science's reign as an interesting, fascinating area of scientific discovery ends? Will there continue to be support for scientific research in general?

Other participants commented on the need for increased science classes in the secondary curriculum. Such training would provide a more solid background in the fundamental areas of science and perhaps promote a greater appreciation of science and the process of science. One participant suggested that textbooks ought to include sections and chapters on microgravity science and other space sciences. Early introduction to this branch of scientific research might lead to continued support later in life.

Scientific ignorance may continue unless new goals are set in science education. Penick (1995) suggested that educational reform will occur only if instructional reform comes first. He believes teachers must be able to communicate scientific knowledge to students in fun and exciting ways. Through innovative teaching, students learn to like science, feel confident in their scientific abilities, find science useful, and yearn to learn more about science. According to Penick, discussions with teachers of all grades throughout the United States have yielded student goals that differ from traditional textbook objectives. Outstanding teachers want students to "use science knowledge, identify and resolve problems, communicate effectively, like science and feel successful at it, be creative, and continue learning science" (Penick, 1995, p. S-53). The focus in education should be on creating an environment that is conducive to learning (Penick, 1995).

Promoting microgravity science

While the majority of participants expressed the desire to increase the level of awareness and appreciation of scientific research and development, at least one participant believed that it is necessary to publicize how scientific research is going to provide a direct return on its investment. The public is going to want to know how its money is being spent; therefore, promoting the benefits of microgravity science in terms of how it will improve the quality of life is a must.

Although it was explained that microgravity science programs are dedicated to strictly fundamental research, participants believe it is necessary to identify the commercial benefits of the research that is being conducted. However, participants were hard pressed to recall commercial benefits provided by NASA. Some suggested that NASA actually run infomercials to promote its latest findings and discoveries.

Several participants suggested that NASA needed to publicize the fact that many products are the result of their research programs. This might include the NASA logo on products or a fact sheet as part of product packaging. However, one participant pointed out that doing so might give the impression that certain products had the government's seal of approval because it happened to be developed from a federal agency's research. This could be a problem if any of the products are controversial or dangerous. The government might be held responsible for endangering lives or using taxpayer money for unsafe or controversial products. Another group member said that companies would benefit from the NASA endorsement. People would see that the product was the result of research by NASA scientists and think it must be a great product. Moreover, NASA will be unable to promote the fundamental research that eventually resulted in the company's product, according to one participant.

Message presentation and interpretation

One participant argued that the public really is interested in science. His evidence: science fiction movies. Star Trek has been one of the best things that has happened to NASA, according to this participant. A lot of moviegoers believe that what they see in science fiction movies is possible. It is the science community's task to explain to the public that what they see in the movie will be possible, but there are steps, e.g., microgravity research, that have to be taken before these possibilities are realized. Unfortunately, scientists do not always communicate effectively with the public because they use jargon that is difficult to understand. Therefore, the public misinterprets the information and never truly understands the scientific concepts that are fundamental to scientific discovery, said a participant. According to another group member, producers and directors are very efficient at relaying messages to the general population. These are the people who can help create awareness and even understanding of microgravity research.

Other information outlets suggested by participants included science museums and amusement park rides. NASA could sponsor a "microgravity ride" that simulates the microgravity environment for the public. While waiting in line, riders could view a video about microgravity science research and its importance. Such exposure to microgravity concepts could stimulate interest in the microgravity program and increase support for NASA's endeavors.

COMMUNICATION PLAN

> *It is quite clearly the responsibility of every scientifically literate person to combat the extreme ignorance of the most elementary scientific facts and theories that we find even among the best educated of our friends and colleagues. Every possible means should be taken to improve the transfer process in the science museum, in the schools, in the media, or wherever (Ziman, 1991, p. 100).*

Overview

Given the ultimate goal of drafting a Microgravity Research Program Outreach and Education Strategic plan, various communication outlets have been identified as appropriate dissemination vehicles. The recommendations for this communication plan are based on a review of relevant literature, responses of focus group members, and an examination of on-line web sites of various media outlets.

Ironically, many of the communication outlets described in this report were identified by members of the public a few years ago as ways to increase awareness of NASA's activities. According to an article in Omni magazine, NASA conducted six "town-meetings" to assess public perception of the organization and its programs. The participants indicated an interest in NASA and its operations, but they were unable to articulate what NASA actually does. Participants suggested NASA "use public and cable television, computer bulletin boards and networks, and promotions with fast-food restaurants--even sponsor the half-time show at the Super Bowl--to communicate with the public" (David, 1993, p. 24). One participant urged NASA to advertise what it is doing by putting its logo on every product that is connected with its programs (David, 1993). Furthermore, town meeting participants encouraged NASA to better supply educators and students with science materials (David, 1993).

The Need for Mass Media

As noted earlier, the public's level of scientific knowledge is quite low. Leaders in the scientific community charge that the mass media can help raise the level of knowledge through effective communication. Robert M. White, president of the National Academy of Engineering, believes there is a partnership between the public media and the scientific and technical community. This partnership is important because agents of the media have a significant role in interpreting messages from the scientific community and informing the public. It is vital for the public to understand scientific information because of its effects on daily living and "because governmental policies are ultimately shaped by public attitudes" (White, 1994, p. 431). The scientific community needs to develop new methods of message dissemination that extend beyond the press release because with each passing year there is a greater need for public understanding of science and technology (White, 1994).

Others echo White's sentiment. Authur Kornberg of Stanford University calls for the scientific community to use the media to get across the message that basic research is essential to science (Kornberg, 1995). According to Cronholm and Sandell (1981), the mass media are the channels through which the public, including scientists, receive scientific information. However, the mass media may not directly affect the public's understanding of science, rather they only make the public aware of scientific issues. The public chooses to seek further understanding or not.

There is an undeniable connection between the mass media and educating the public about science. This connection is the primary pathway to creating a scientifically literate public.

Traditional coverage

According to the focus group members, the broadcast press made little mention of the re-flight of NASA's MSL-1 mission. Although some participants visited various NASA web sites to gather additional information about the mission, most were unaware the mission took place and had no idea of the mission's goals. This researcher's observations of WESH-TV 2, the NBC station in Orlando, Florida, yielded findings consistent with those in the focus groups. If there was a mention of the shuttle mission, it often had to do with when the shuttle was going to land and what the weather would be like. Such coverage is logical for the local station because the shuttle lands in the area. However, it is surprising more in-depth coverage of the mission was not provided. Of course, the microgravity research program's recent shuttle mission was upstaged by the Mars Pathfinder and the problems on the Russian space station, Mir.

In order for microgravity science to grow in popularity, NASA must make the public aware that such research is happening. Local and national news programs are an excellent way to disseminate knowledge about microgravity research; however, NASA is at the mercy of the producers and editors to determine what and how much information is presented to the public. Cronholm and Sandell (1981) support this view. The authors suggest that the public is at a disadvantage because scientists and science journalists do not always report the information the public needs to make informed decisions. Some journalists see science as stimulating, but inconsequential, others view it as a societal menace, and still others see it as "the salvation of humanity" (Cronholm & Sandell, 1981, p. 87). Scientists may view their research as exclusive to a select few, while others freely report their findings. All of these views dictate what information will reach the public (Cronholm & Sandell, 1981).

"New" Methods of Dissemination

Given these limitations on information dissemination, NASA should look to other outlets to increase public awareness of microgravity science. While the traditional broadcast and cable news programs are useful to provide a cursory overview of NASA's latest discoveries, other outlets present a wealth of opportunities to increase awareness and provide understanding. These outlets include The Discovery Channel, The Learning Channel, and PBS.

NASA needs to heed the suggestion of the focus group participants and allow communication specialists (i.e., writers, directors, and producers) to help them get out their messages to the science attentive public and the public in general. While microgravity science experiments may not be the most exciting material to watch, it is an intriguing area of research that provides for interesting possibilities. Science program producers could develop a series of programs that focus on the five areas of microgravity science research. Such a series could be part of The Learning Channel's *Science Frontiers* (Discovery Communications, 1997d) series or the Discovery Channel's *Assignment Discovery-Exploring Space* (Discovery Communications, 1997a) series.

The Learning Channel also offers two other series, *Popular Science* and *How'd They Do That?* (Discovery Communications, 1997c), that are potential outlets for microgravity science. These programs would be useful for discussing the practical applications of microgravity science research. Similar programs would be appropriate for the Discovery Channel's science network (Discovery Communications, 1997b).

NASA has underutilized the Discovery Channel. A search of the last nine months of programming revealed that less than ten programs focusing on NASA had been aired (Discovery Communications, 1997d). With the original flight of MSL-1 and its re-flight occurring in the past nine months, no mention of the microgravity research program was found. A search of The Learning Channel's programming resulted in no programs dealing with NASA (Discovery Communications, 1997d). It is clear that NASA's microgravity research program needs to tap into these valuable media outlets.

In addition to the outlets provided by the Discovery Channel and The Learning Channel, PBS offers a number of series that are useful for educating the younger generation (PBS, 1997b). Of course, *Bill Nye the Science Guy*, has been long associated with NASA. However, an examination of his program schedule did not reveal programs dealing with microgravity research (Nye, 1997). If anyone can help promote this area of research, especially to children, it would be Bill Nye. With his humorous, fun approach to science, he could help reduce the intimidation associated with microgravity.

Newton's Apple, an educational series on PBS, is yet another series that targets children (PBS, 1997a). This program has curriculum materials that can be used to supplement what is broadcast. Therefore, teachers can capitalize on the interest created by the program and continue educating students about microgravity research and its benefits to their lives.

Beakman's World, which airs on CBS, is also a series that makes science fun for kids (Sony Pictures Entertainment, 1997). With its "eye-popping" experiments, this program connects scientific principles to daily life in a meaningful and revealing way. This program series could introduce some of the more fundamental microgravity concepts to kids, which may spark an interest in this branch of science later in life. As focus group participants suggested, it is necessary to open children's eyes early in order to sustain support for science in the future.

NOVA provides a variety of programs that favor tackling microgravity science (PBS, 1997b). For example, NOVA produces programs that focus on medicine/disease and research (PBS, 1997a). One of these programs could focus on the role of microgravity research in attempting to discover the cure for skin cancer and the flu. Programs that focus on technological advancements could address how microgravity science is an integral part of creating better micro-chips (PBS, 1997c).

Other PBS programs that can serve as dissemination vehicles for microgravity research include *Mysteries of Deep Space, Scientific American Frontiers,* and *The New Explorers* (PBS, 1997c).

Furthermore, most PBS programs are underwritten by various corporations and organizations. Corporations that offer products and services created from NASA microgravity research should be encouraged to underwrite programs that explain how their product or service was developed from microgravity research and how it improves the quality of life.

CNN also offers several outlets well suited for discussions and reports about microgravity science (CNN, 1997c). The cable network airs three weekly programs that would attract science attentive individuals as well as the general public. *Science and Technology Week*, hosted by Ann Kellan, is the most obvious program because its focus is on the latest developments in science and technological advancements (CNN, 1997d). *Future Watch*, hosted by Donna Kelley, provides a platform for discussing how microgravity research will affect the future of our world (CNN, 1997a). Bernard Shaw hosts *Impact*, a show about recent world events that are having a profound influence on society and the world (CNN, 1997b). This program is where NASA can promote its more significant discoveries (e.g., a cure for skin cancer).

This researcher believes that cable programming and public broadcasting are the keys to improving the science attentive public's awareness and understanding of microgravity science research. However, as several focus group participants suggested, programs like NBC's *Dateline*, ABC's *20/20*, and CBS's *60 Minutes* are excellent outlets to keep the public informed about the latest NASA activities. Since a more heterogeneous audience tunes into these programs, more of the general public can be exposed to microgravity science. By creating awareness via these mainstream news programs, the average citizen may be more likely to tune into the cable and PBS programs.

The Internet

While television is the key to increasing *awareness* of microgravity science, the Internet can be considered the key to promoting *understanding* of microgravity science. **The Internet is a fabulous medium on which NASA can promote its microgravity science research because of the multimedia environment. Visitors to a site can see, read, and hear** about microgravity science for as long as they like. NASA's Microgravity Science Laboratory-1 web site is the resource for anyone interested in understanding what microgravity science is and the impact it has on our world. The problem is that not everyone knows that it exists.

Fortunately, the Space Sciences Laboratory has created a pamphlet promoting the on-line resources available to the scientific community and public at-large. Additional promotions are necessary to attract more individuals to the web site. One way to attract more visitors to the site is by providing the web address on all materials and programs that are produced. For example, if NASA was to produce a five-part series on microgravity science to be aired on The Learning Channel's *Scientific Frontiers* series, the web address should be prominently displayed before each commercial break and at the end of the program. This will allow interested viewers to visit the web site and to gain a greater depth of understanding. Similar promotions can occur on local and national news programs. Often news reporters and anchors need a tag-line to wrap up a story; what better way to wrap up the story than providing a web address where viewers can get more information. Obviously, this is a common practice among broadcasters today, but NASA needs to take advantage of the opportunity as others have.

Science-fiction films

Through television and the Internet, NASA has an opportunity to reach the science attentive public and promote increased awareness and understanding of microgravity science. Moreover, NASA can capitalize on feature films to promote its research and latest discoveries. Ron Howard's film, *Apollo 13*, starring Tom Hanks, stimulated new interest in NASA's space program a few years ago. The film, *Contact*, starring Jodie Foster, piqued interest in the possibility of intelligent life in other parts of the universe.

NASA could work with producers to develop feature films that include elements of microgravity research. Tom Hanks and Ron Howard are continuing their work on space exploration through a series of films for HBO. NASA should continue to collaborate with these Hollywood insiders and solicit them to weave microgravity research endeavors into the story line of their films. This could expose the public to microgravity discoveries and stimulate more interest in learning about that area of science.

While the general public and science buffs will be intrigued by a film and the possibilities it purports, it will be students who can benefit most. Dubeck, Moshier, Bruce, and Boss (1993) explained that watching and analyzing concepts within science-fiction films help students gain a better understanding of science as a discovery process and improve their attitudes towards science. Dubeck and his colleagues proposed that science-fiction films help students learn in four ways. First, films help students understand abstract concepts in familiar and attractive ways. Direct visualization of abstract principles is a key to understanding. Second, students learn science is a rational process as well as a discovery process when they view and discuss a film. They learn to recognize scientific and pseudoscientific approaches. Third, science-fiction films make science more relevant to students because they place science in dramatic settings and relate it to socially significant issues. Fourth, films allow students to experience science within interdisciplinary settings, which is more like the "real world."

Allen (1993) uses science-fiction material in the classroom. She uses one of popular culture's best known science-fiction television series, *Star Trek*, along with its derivatives *Star Trek: The Next Generation* and *Deep Space 9*. Use of all three television series allows Allen to capitalize on the use of stories to illustrate educational theories and practices. She explained that students appear more attentive and focused when she tells a story. The most appealing aspect of using "Star Trek" and its off-shoots in the classroom is that the shows provide common ground for the teacher and students. Allen noted it is important to relate her teaching to student experiences and interests. "Making connections is vitally important for making learning come alive" (Allen, 1993, p. 2).

Star Trek is among other media--books, movies, magazines, other television shows--utilized by Allen. She emphasized that the media have an important influence on students' lives and called for educators to take advantage of the media's valuable resources. "The knowledge we want to teach, the skills we want to develop, and the attitudes we want to instill can all be accommodated by utilizing the media" (Allen, 1993, p. 18).

Education

Research indicates that scientifically literate people often have a positive attitude toward science; therefore, it is important to foster a positive attitude in students. Penick (1995) argued that students with positive attitudes are successful in science. He calls for the need to ensure such success for everyone. By cultivating a positive attitude towards science, students are more likely to be active citizens who use their scientific knowledge to identify and solve problems (Penick, 1995).

A positive attitude is a result of an active classroom (Penick, 1995). Effective teachers create an active classroom by relating the material to students personally and having students do more than listen. Students have to talk, take action, do the science (Penick, 1995). Outstanding teachers run "laboratory-centered, student-active classrooms. The most effective teachers in the United States do some kind of hands-on activity every single day" (Penick, 1995, p. S-55). This is often the exception rather than the rule. Many focus group participants reiterated Penick's desire to promote a positive attitude toward science.

Science educators report an undeniable connection between the mass media and science teaching. However, this connection is not always used to its fullest extent. Johnson (1993) called for the educational use of the popular media as an instructional and informational resource in lower level general education courses. Inherent in this plea for the use of the media in the classroom is the desire to help students see the social implications of course content.

Johnson (1993) stated that "it is vital that we do more than just call a science course 'general education science.' It must provide the student with a strong sense of connection" (p. 55). The strong sense of connection is found in the popular media, ranging from newspapers and newsmagazines to special interest and hobby magazines to radio and television (Johnson, 1993). These information sources are often easier to understand than textbooks, and they highlight the impact of scientific knowledge on personal and social levels (Johnson, 1993).

Moreover, popular media help students learn material that is difficult or omitted in the course textbook, and it fosters critical thinking skills when information is inaccurate or biased and used to influence public opinion (Johnson, 1993). Media sources help students "appreciate and understand the relatedness of knowledge and to be impressed with its impact on their life" (Johnson, 1993, p. 55).

It is clear that mass media play a vital role in science education. Therefore, NASA must utilize cable and public television along with traditional broadcast outlets to begin its microgravity education campaign. The agency must also continue to maintain its position on the Internet as the source of microgravity science information and promote itself as such. Once the level of awareness of microgravity science has been increased, then the focus of the communication plan can shift to the print media. The print media, whether it be newspapers, general interest magazines, science magazines, science journals, or books, are the communication vehicles necessary for increasing understanding of microgravity science. However, without awareness there will be no understanding.

APPENDIX A

Microgravity Science Survey

This survey is designed to assess science attentive individuals' level of awareness of microgravity science and identify sources of microgravity science information.

Instructions: Please **CIRCLE** or **WRITE** your response as appropriate.

Knowledge of Microgravity Science

1. I can accurately define the term "microgravity."
   (If you AGREE with this statement, proceed to **question 2**. If you DISAGREE with this statement, skip to **question 3**).

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

2. Briefly define microgravity.

____

____

3. I am aware of microgravity science concepts.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

4. I understand microgravity science concepts.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

5. I am aware that NASA has a microgravity science research program.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

6. I am aware that NASA's microgravity science program includes biotechnology research.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

7. I am aware that NASA's microgravity science program includes protein crystal growth research.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

8. I am aware that NASA's microgravity science program includes combustion research.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

9. I am aware that NASA's microgravity science program includes fluid physics research.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

10. I am aware that NASA's microgravity science program includes materials science research.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

11. I am aware that NASA's microgravity science program includes space flight research.

Strongly Agree **1** **2** **3** **4** **5** **6** **7** *Strongly Disagree*

12. I am aware that microgravity science research has been conducted on several NASA space shuttle missions.

Strongly Agree **1** **2** **3** **4** **5** **6** **7** *Strongly Disagree*

13. I am aware that future microgravity science research will take place on NASA's space station.

Strongly Agree **1** **2** **3** **4** **5** **6** **7** *Strongly Disagree*

14. I want to know more about NASA's microgravity science research.

Strongly Agree **1** **2** **3** **4** **5** **6** **7** *Strongly Disagree*

15. Please rate the level of your overall awareness of microgravity science.

Very Aware **1** **2** **3** **4** **5** **6** **7** *Not at all Aware*

** If you are **COMPLETELY UNAWARE** of microgravity science, please **STOP!**

Sources of Microgravity Science

16. I get information about microgravity science from television.

Strongly Agree **1** **2** **3** **4** **5** **6** **7** *Strongly Disagree*

17. I get information about microgravity science from the Discovery Channel.

Strongly Agree **1** **2** **3** **4** **5** **6** **7** *Strongly Disagree*

18. I get information about microgravity science from the Learning Channel.

Strongly Agree **1** **2** **3** **4** **5** **6** **7** *Strongly Disagree*

19. I get information about microgravity science from PBS (e.g., Bill Nye the Science Guy, NOVA).

Strongly Agree **1** **2** **3** **4** **5** **6** **7** *Strongly Disagree*

20. I get information about microgravity science from CNN.

Strongly Agree **1** **2** **3** **4** **5** **6** **7** *Strongly Disagree*

21. I get information about microgravity science from radio.

Strongly Agree **1** **2** **3** **4** **5** **6** **7** *Strongly Disagree*

22. I get information about microgravity science from newspapers.

Strongly Agree **1** **2** **3** **4** **5** **6** **7** *Strongly Disagree*

23. I get information about microgravity science from magazines.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

24. I get information about microgravity science from the Internet.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

25. I get information about microgravity science from books.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

26. I get information about microgravity science from textbooks.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

27. I get information about microgravity science from prerecorded videotapes.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

28. I get information about microgravity science from scientific newsletters.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

29. I get information about microgravity science from professional scientific organizations.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

30. I get information about microgravity science from NASA.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

31. I get information about microgravity science from NASA TV.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

32. I get information about microgravity science from NASA web sites.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

33. I get information about microgravity science from scientists.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

34. I get information about microgravity science from science professors.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

35. I get information about microgravity science from science journals.

Strongly Agree 1 2 3 4 5 6 7 *Strongly Disagree*

36. I get information about microgravity science from:

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PART ONE: A STUDY OF THE PRINCIPLES and practices of CRISIS COMMUNICATION at MSFC-NASA. INTERVIEWS WERE CONDUCTED WITH MSFC PERSONNEL and local media representatives to ascertain effectiveness of COMMUNICATION EFFORTS. THE STUDY assessed the need for a contingency plan, GOALS AND OBJECTIVES and RECOMMENDATIONS for practices.

PART TWO: A SECOND STUDY INVESTIGATED THE PUBLICS AWARENESS AND UNDERSTANDING of MICROGRAVITY SCIENCE. RESULTS OF FOCUS groups determined that there is a SIGNIFICANT lack of UNDERSTANDING OF MOST MICROGRAVITY PRINCIPLES. RECOMMENDATIONS for reaching the public through appropriate MEDIA OUTLETS are provided

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