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Engaging the18-25 Generation: Educational Outreach, Interactive Technologies, and Space

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In the Fall of 2004, Dittmar Associates conducted a market study exploring the attitudes and perceptions of the American public toward the Vision for Space Exploration and toward NASA in general. Over 1000 people living in the United States were interviewed and asked to respond to questions pertaining to NASA and the space program. In general, the findings of this study supported the earlier results of a July, 2004 Gallup Poll that found widespread support for NASA. In addition, information about underlying motivations, thoughts and concerns about the space program as reported by study respondents revealed significant differences among certain groups with regard to the level of, and reasons for, attitudes toward various components of the Vision for Space Exploration. In particular, Americans between the ages of 18-25 demonstrated considerable apathy toward the space program (with the exception of Mars rovers). This cohort is of particular interest since a forty-year program such as the VSE will carry some of these individuals from the present until retirement. Thus, a follow-up study was done only with this age group in the late Fall and Winter of 2005-2006, further exploring attitudes and soliciting ideas about how to engage respondents and their peers in the VSE. Some results of the study are discussed, together with implications of the findings for the short and long-term sustainability of the Space Exploration effort.

I. Introduction

THE Vision for Space Exploration (VSE) proposed by President Bush in January 2004 calls for humans to return to the Moon, establish a presence there, and use the capabilities developed on the lunar surface as a stepping-off point for further exploration of the Solar System with Mars as the initial destination. Specific milestones include the launch of robotic missions to the lunar surface by 2008, human arrival on the Moon between 2015 and 2020, and the execution of a human Mars mission sometime thereafter.

In the Fall of 2004, Dittmar Associates conducted what we termed a "market study" of the American public's attitudes and perceptions pertaining to the VSE and to NASA in general[1]. The results of this study have been reported elsewhere[2] and will not be repeated here, except for those associated with one group - individuals between 18 and 25 years of age. This cohort is of particular interest in developing a strategy for building constituencies for the VSE. They will progress from young adulthood through retirement, carry the majority of the tax burden, and vote across the entire 40 year period currently envisioned for the duration of the program. Among this group, one finding in particular suggested the potential for negative impact to the long-term sustainability of the VSE; specifically, the relative disinterest for or outright resistance to certain components of the VSE that were expressed by the majority of young respondents. A little over two-thirds (68%) described themselves as "Neutral" or "Not excited or interested" in human missions to the Moon. With regard to human missions to Mars, fully 80% were either Neutral or Not excited/interested. These results and others have generated concern about engaging this age group in support of the VSE, and has led at least indirectly to several high-level workshops in the past 12 months, including one specifically designed to develop interactive technologies for use in the outreach to and education of young adults[3].

The 2004 study addressed the VSE by breaking out several components of the plan, specifically:

- Return to Flight (space shuttle) and completion of the International Space Station
- Mars rovers and future Moon robotic landings

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- Development of a new crew vehicle and human missions to the Moon
- Human missions to Mars
- Funding the VSE

Relatively few demographic variables significantly impacted results of questions focusing on particular parts of the VSE. One notable exception was that young people expressed interest and excitement about the Mars rovers; the strongest proponents of new Mars rover missions were respondents in this cohort. Several were also thinking about robots on the Moon. Of particular interest to some of them was the idea of being able to remotely control Mars or Moon robots over the internet. These respondents (and others) made a direct link between teleoperation of Mars and Moon robots and exploration.

Although this group reported general disinterest in most aspects of the Vision, they had a good deal to say about how to market it to the American public, and to their peers in particular. When asked to imagine that they were in charge of a "new NASA marketing department", young adults suggested outreach and educational efforts that focused on interactive technologies. Specific recommendations included:

- "Make strategy computer games for people to figure out all the things that have to happen to get to Mars"
- "Getting people involved with missions like on the Internet"
- "Do internet interaction [with robots and people] on Mars"
- "Use the Internet to let us drives robots on the Moon and Mars so we can explore there too [along with the robots]"

As has been previously noted, the problem faced by NASA in sustaining the VSE can be viewed as a "marketing challenge" of significant proportions.[4] In order to better understand this particular target market, a second study was undertaken in the late Fall/early Winter of 2005-2006. The goals of this study were: (a) to validate and update key findings from the 2004 survey; (b) acquire elaboration on and expansion of the responses provided by participants in the 2004 study, particularly with regard to attitudes toward human missions; and (c) to better characterize recreational and educational interests that might be used in formulating an outreach/education campaign to build a space constituency in the cohort.

II. Method

What follows is a brief overview of the survey method and discussion of some of the choices made in developing and administering the survey.

A. The Questionnaire

The original Market Study included questions designed to explore some variables that might impact American attitudes toward the VSE, with particular attention to those aspects of the program that occur in the "out years", beyond the planned completion of the International Space Station assembly missions in 2010. As a result, several of the research questions in the first part of that survey focused on robotic and human missions to the Moon and to Mars. In order to compare responses from the first study to the present follow-up, many of these questions were repeated in the second survey. However, some additional questions were developed which focused on specific concerns, experiences and capabilities relevant to the 18-25 year old cohort. Specifically, two questions were designed to access the degree to which the Moon landings were accepted as historical fact. Other questions were explored the role that might be played by technology in education and in engaging the public generally in the Vision for Space Exploration. Finally, questions were developed to identify the degree to which respondents are aware of efforts in the "New Space" arena - i.e., space-related endeavors outside of "traditional NASA" such as the X Prize flights of Space Ship One, the general topic of space tourism, and/or any other commercial or international efforts pertaining to space activities that were not necessarily based in the U.S. space program. The entire list of questions for both the first and second surveys may be found in Dittmar, 2006.[5]

Solicitation of underlying public perceptions toward the Space Program was achieved by the use of interview questions. Typically, individuals were first presented with a "rating-type" question on a topic. Examples include questions wherein participants were asked to rate the degree of their agreement with a statement, to rate their support for the program, or to rate relevance of the program, etc. In some cases, a follow-up question was presented, in which respondents were asked to provide additional information to the interviewer regarding their previous answer.

These questions were intended to engage participants in a dialogue by inviting them to "tell us more" about their opinions. At times, additional clarification was sought when the initial answer was unclear as to meaning.

B. The Sample

The original Market Study was a questionnaire was administered to a sample of 1,029 Americans contacted by phone using a method whereby phone numbers were randomly generated within area codes. Those questions consisting of "yes/no" or rating responses have an estimated error rate of $\pm$ 3% for aggregate responses – that is, when the entire sample is used. Further stratification of responses was developed and analyzed. When presented in by demographic variable (for example, "age of respondents"), the average error rate was approximately $\pm$ 5%.

For the present survey, however, traditional polling methods were not utilized across the entire sample. As a result, the outcome of this study cannot be considered "scientific" - that is, it is susceptible to sampling bias as well as other factors that may diminish the extent to which the results may be generalized to the larger population. Ironically, the reason for non-random sampling arises from concerns about the validity of traditional survey methods and their access to 18-25 year old Americans. More than any other before it, this generation relies on "new media" for communication - cell phones, instant messaging, chat rooms, internet boards, websites, text messaging, etc., for personal communication. Anecdotal evidence suggests that an increasing number of individuals in this age group use "land lines" little (if at all) for personal communications. If true, this pattern of behavior raises serious questions about research efforts that address this generation through home-based phones, introducing the possibility that the resulting data are themselves susceptible to significant sampling error (for example, socio-economic status may influence access to and use of various communication media, resulting in over or under representation of various economic groups.) Reasoning that in either case we could not identify factors that might impact the generalizability of the results, we chose a mixed approach - that is, a random and non-random sample of sufficient quantity to provide a starting point for further research and discussion of the results. It must be noted, however, that under these circumstances, sampling error cannot be estimated.

The sampling methodology was thus made up of both traditional and non-traditional means. 250 young adults were contacted by phone at home, using the same sampling approach as in the original study. All were screened for English proficiency. Another 162 persons were contacted by means of placing posts in chat rooms on AOL, Roadrunner (in selected cities), Charter Communications, and others. In each case, the posts solicited participation in a study concerning attitudes toward the U.S. space program, and specified that only residents of the United States were being sought. A URL was provided which in turn presented a basic screening for English and asked respondents to leave phone numbers where they could be contacted. Another 88 participants were solicited using essentially the same method with the posts placed on public internet boards, including Yahoo, My Space, and MSN.

Development and pilot testing of the questionnaire and electronic methodology took place during October, 2005. The final version of the questionnaire was deployed late in October and the survey completed by mid-February, 2006.

C. Demographic Variables

The demographic variables selected for analysis in this study are listed here, together with their associated ranges. With only a few exceptions, the ranges and definitions of the variables are identical to those used by the U.S. Census Bureau.[†]

1) Gender (male/female)
2) Level of education (9th grade through doctorate or terminal degree)
3) Occupation type (mgmt./professional, service, sales and office, agriculture, construction, government (including military), retired, unemployed, other)
4) Ethnic background (African American, Asian, White, Latino/Hispanic, Native American, other)
5) Marital status (married, separated, single, divorced, widow/widower, other).

[†] Accessible at http://www.census.gov/popest/estimates.php

D. Analysis

Following the methodology for data analysis used in the original Market Study, all answers were recorded verbatim at the time they were answered. Since this was a non-random sample, the assumptions governing the use of Gaussian statistical methods could not be applied. Similarly, non-parametric methods, while somewhat more flexible in their application, still rely on certain assumptions and guidelines that could not be met with this sample. As a result, all findings are based upon descriptive statistics and qualitative analysis of verbal discussions and, as such, should not be assumed to represent anything other than the response of the specific participants engaged in this survey.

With regard to the interview questions; the data were reduced and then categorized by independent judges. After statistical analysis to validate the categorization process, all responses were mapped back into the final categories and the percentage of responses in each category was tallied. All categories used to describe the responses of participants to interview-style questions were determined by this method.

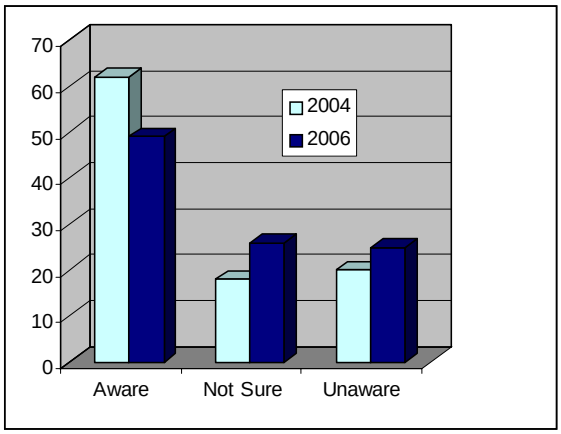

Figure 1. Percentage of Americans aged 18-24 who indicated they were aware, unaware, or not sure of the existence of the Vision for Space Exploration.

III. Results

Owing to space constraints, only a small portion of the entire results set will be presented here. In general, only aggregate results will be discussed; however, it is important to note that, as in the original study, some differences emerged among demographic groups, particularly when considering ethnic background and gender. In one or two cases these differences will also be presented.

A. American Support for Space Exploration Remains Strong

Perhaps the clearest result of this study is that it confirms the results of a July 2004 Gallup Poll[6] as well as the results of the 2004 Market Study describing ongoing public awareness and engagement with the idea of human space flight. However, among young persons, the majority (aware) is somewhat less than in the earlier study. Figure 1 presents the results of the question that solicited information regarding whether or not respondents were aware of the Vision for Space Exploration in 2004, with 62% of the sample indicating that they were aware of the VSE, 20% indicating that there were not aware, and 18% who were not sure. In 2006, slightly less than half (49%) indicated that they were aware, 25% were unaware, and 26% were not sure. Of those who indicated they were aware, follow-on queries regarding specific domain knowledge revealed that awareness was vague, with "something about going back to the Moon" characterizing the majority of positive responses (61%).

Support for the Space Exploration program is also slightly less than in 2004, while opposition appears greater. In 2004, 55% of young Americans endorsed the plan, with 30% opposed. In 2006, 45% of respondents reported support for the plan, and 40% opposed it. These results are presented in Figure 2. As is often the case, however, aggregate results may mask differences among demographic groups. With regard to awareness and support of the VSE, one such group difference was found with respect to gender. Men indicated both a greater awareness of and stronger support for the VSE than did women, by a ratio of 2:1. Among ethnic groups, the positive relationship between awareness and support was repeated. For example, Hispanic

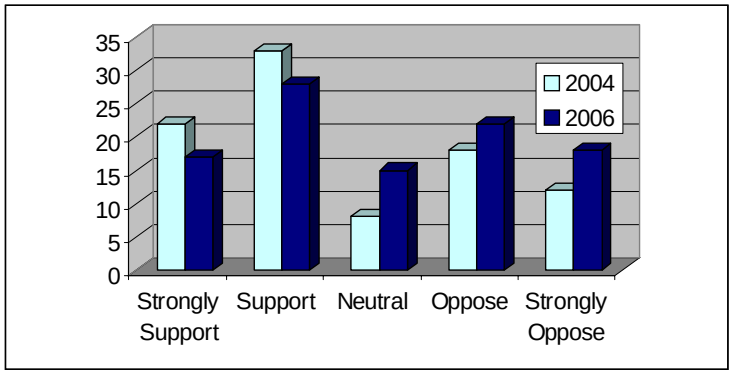

Figure 2. Percentage of Americans between 18 and 24 year of age expressing support, neutrality, or opposition to the Vision for Space Exploration

respondents, there were relatively lower degrees of awareness of the VSE (40%) and 42% support. On the other hand, Asian respondents reported somewhat higher levels of awareness (60%) and similar levels of support (61%).

Questions about specific aspects of the VSE also yielded varying results with regard to awareness. For example, only 32% of respondents reported meaningful awareness of the International Space Station, while 61% were aware of the Mars rovers, and 72% recalled the Columbia accident. Follow up questions revealed that awareness was "wide but not deep" with respect to the last two topics, with very little specific information reported about the Mars rover program, and a considerable amount of misinformation emerged regarding the proximate cause and course of the Columbia accident.

B. Support for the VSE Varies as a Function of Time and Mission

1. Near-term vs. Far-term Vision

During the survey, components of the Vision for Space Exploration were presented separately as individual programs or missions, and then as a whole representing the entire scope of the VSE. With regard to short term activities, only 8% of participants were aware that Return to Flight was one of the near-term goals of the VSE. More notably, only 28% were able to answer basic questions about the International Space Station, including information about its location (Near Earth Orbit), the international partnership supporting it (including Russian participation), the number of crew aboard (two at the time of the survey) - and 32% were completely unaware that there is an ISS.

The original finding in support of rover missions was repeated; 52% endorsed more Moon/Mars rover missions. However, with regard to human missions to the Moon, 49% indicated that they were "neutral", 29% reporting that they were "interested or very interested", and 23% reporting that they were "disinterested or very disinterested". Approximately as many supported a return to the moon (35%) as opposed it (33%). Mars missions, however, were a different story, with opposition running 3:1 (77% to 18%). Typical reasons cited for opposition to human missions to Mars included statements such as "Don't know why we're going there when we're so messed up here", "too far and too much money", "don't think we can get there", and "don't see the point". These results closely followed those of the general public in the 2004 survey, wherein the majority of respondents expressed a lack of clarity regarding the purpose and benefits of a Mars mission.

C. Relevance

Previous polls have also asked questions about support/opposition to the space program. As with the original study, the present survey encompassed an approach designed to explore other thoughts and feelings that might lie beneath expressions of support or opposition. We began by repeating a question asked in 2004 regarding relevance in an attempt to get at the meaning assigned to NASA and the space program with regard to respondent's personal lives. In 2004, the majority of respondents described NASA as relevant or very relevant, rather than irrelevant or very irrelevant (52% to 35%); however, among individuals aged 18-25 those numbers were somewhat different, with 43% indicating that NASA was either relevant or very relevant to their personal lives. Regardless of how people responded to the question regarding relevance, however, in 2004 the majority of respondents indicated that they were aware of and appreciated the technical and social benefits of the space program. That result was one of the most pervasive findings in the earlier survey.

In 2004, Americans were worried about terrorism, about the U.S. economy, and about funding for programs such as defense, healthcare, and education. When asked about funding, it was these concerns that influenced many of those who supported leaving NASA funding at or below its current level of funding. That finding was consistent with previous surveys. However, the degree to which Americans rated NASA as relevant was even more strongly related to their support for NASA funding, in a logical direction: Those Americans who believed NASA programs were relevant to their day-to-day lives were much more likely to support increased NASA funding than those who do not. As noted in a previous paper, this finding may have direct implications for marketing the VSE; i.e., improving the perceived relevance of the agency's work may improve willingness to support increased funding[7].

In 2006, however, the majority of young adults participating in this study see NASA as irrelevant, and some question its historical contributions as well. A few of those findings are summarized here:

- 32% view NASA as "relevant or very relevant"; 17% were "neutral", and 51% regard NASA as "irrelevant or very irrelevant"
- When asked about relevance in another way, 39% indicated that "nothing useful has come out of NASA"
- 72% believe that money spent on NASA would be better spent elsewhere
    - jobs
    - defense

- 27% expressed some doubt that NASA went to the Moon, with 10% indicating that it was "highly unlikely" that a Moon landing had ever taken place
- In contrast to the tepid response to NASA, 61% of respondents indicated that "new space" endeavors such as the flight of Space Ship One and the possibility of space tourism are relevant or very relevant to their lives - the primary reason cited was that "regular people can get to go".

D. Engagement and Education

As in the original study, respondents believed that more can be done to promote NASA and the space program. The most frequent response to the initial question regarding outreach was "I don't know" - however, when followed up, young people had a great many ideas. A content analysis of the suggestions made in the 2006 survey generated many of the same categories of outreach and educational activities as those that emerged in the 2004 study, specifically:

- Celebrity endorsement (primarily music and television, comedians)
- Appeal to self interest (contests and prizes, publicity, opportunity for jobs/careers)
- Educational activity ("Astronaut corps" (similar to ROTC), astronauts in classrooms, young person on ISS in a "reality tv" setting, more interactive educational opportunities both in the schools and online)
- Alternative broadcasting - i.e., netcasts, podcasts, streaming video accessible via cell phone, etc.
- Multilingual programs, particularly in Spanish and English
- Interactive technologies

With regard to the last of these, a great many suggestions were made, some of them technically achievable given current capabilities and others that were not as realistic. In general, these fell into two, overlapping categories: (a) robotics, and (b) internet-based activities. As noted, there is considerable interest in the opportunity to interact with Mars (and Moon) rovers via teleoperation, and also via remote camera manipulation and reception of the images ("webcam on the Moon"). Several other suggestions that centered on robotics included "Battlebots on the Moon", wherein robots built or manipulated by ordinary people could engage in one-on-one battles, and "Legos on the Moon", wherein robots - again manipulated by people online - build small structures, engage in mining or transport, etc.

The other class of interactive technologies pertains to computer-based interactions, either with personal computers or with other human beings over the internet, including peer-to-peer file sharing such as viral marketing videos. Specific examples included social internet sites (uploading space related video on YouTube, blogging on MySpace), multiplayer networked gaming (a government-sponsored example is known as "America's Army"), computer games at home, multiplayer networked simulations, and "IM from Astronauts".

IV. Conclusions

A. The Vision is Irrelevant

Collectively, several conclusions may be drawn from 2004 Market Study for Space Exploration and the subsequent study focused upon young Americans during 2005-2006 and reported here. The first is that many young people are not aware of the Vision for Space Exploration and, if they are aware, they are disengaged. This is in contrast to high levels of awareness of "new space" endeavors, although this awareness appears primarily linked to the X Prize flights of Space Ship One. When asked about relevance - which in the original study was a strong predictor of attitudes toward NASA funding - 69% of respondents felt NASA was either irrelevant or were "neutral" on the subject. As pointed out, 39% of respondents believe that nothing worthwhile has come out of NASA. Space Ship One, on the other hand, appears to offer the promise that "anyone can go" - a distinction that appeared meaningful to those individuals who are at all interested in space.

Like the larger sample in 2004, young American adults in 2006 are worried about terrorism and about jobs. Taken together with the present survey, the results suggest weakening support for NASA among individuals aged 18-25, particularly when considered alongside issues such as war, education, and careers. Further research is needed to clarify and validate these findings, particularly in light of the sampling issues described above. Outreach and education efforts, however, can be accelerated and transformed in the near term.

B. The Message and the Media

A revolutionary shift in communications is taking place, and nowhere is this more evident than in the use of media by young Americans. Vblogs, blogs, text messages, instant messaging, chat rooms, cell phones, peer-to-peer file sharing (including viral videos), social websites, podcasting, networked gaming - all of these are now used to tie individuals and groups together with others, with activities, and with ideas. One consequence of this revolution is that information and activities are increasingly available "direct" - that is, the consumer need not go anywhere or expend much effort to seek out a wide range of opportunities for entertainment, education, or interaction. Creating motivation in and interest about the Vision for Space Exploration in the 18-25 year old cohort requires a focused outreach campaign designed to make use of all of these media (and more), simultaneously, in a direct and personal way. Similarly, educational approaches that make use of a broad variety of interactive media and present opportunities for participation in activities that encourage learning and application of critical skills are more likely to engage and sustain interest. In fact, outreach and education programs that fail to do so are likely to be rejected; many respondents spontaneously indicated that their ability to select from a broad interactive menu determining the "what" and the "how" of their academic and leisure activities is simply expected.

Taken together, the following architectures are recommended when considering the development of effective educational and outreach campaigns pertaining to the Vision, to space, and to related fields such as science, math, and engineering:

- Make full use of "new media", simultaneously, targeted
  - Podcasting, blogging, vblogging, texting, IM, etc.
- Build "broadcast" opportunities into missions
  - Webcams, mixed media, remote views, available bandwidth
- Develop computer games from home and multiplayer venues
  - "SimSpace", networked gaming, sim missions, use internet to build collaborative projects using full range of available media
- Develop strong pedagogical content and adapt for new media (use instructional system design techniques)
- Develop multi-age, multi-stage projects
- Use viral videos and other new marketing techniques
- Be multilingual
- Be "fast" - allow for rapid change in incorporation of new/updated technology

Finally, it is worth noting that young adults in the United States do not appear to equate space or humans in space with NASA uniquely. Although interest in rovers remains strong, and generates more enthusiasm for NASA than does any other activity or achievement considered in this survey, this interest is at least partly due to a perception that the rovers are "accessible" - or potentially accessible - either through technical means or simply as a result of easy availability of visual information pertaining to their mission. In 2004, young adults indicated that rovers were responsible for their positive regard of NASA but were specific that this regard did not carry over to human space flight. In 2006, it is clear that human space flight now includes the possibility of space tourism, and it, too, appears potentially accessible. Embracing and incorporating the new opportunities that may in time be afforded by commercial ventures in space represents a venue for educational programs that has yet to be considered.

Acknowledgments

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References

[1] Dittmar, M. L. (2004). The Market Study for Space Exploration. Dittmar Associates Inc., Houston, TX.
[2] Dittmar, M. L. (2005). "Some Results from Dittmar Associates' Market Study for Space Exploration", *Proceedings of the First AIAA Space Exploration Conference*, AIAA, Washington, D.C., 2005.
[3] Dittmar, M. L. (2006) Dittmar Associates' Market Study for Space Exploration. Presented at the Sim-Space Organizing Meeting, NASA Ames, San Jose, CA, February, 2006.
[4] Dittmar, M. L., (2004) "The Politics of Space Economics", *Proceedings of AIAA Space 2004*, AIAA, Washington, D.C., 2004.

[5] Dittmar, M. L. (2006). The Market Study for Space Exploration (2nd ed.). Dittmar Associates Inc., Houston, TX.
[6] The Gallup Organization, "Public Opinion Regarding America's Space Program," July, 2004.
[7] Dittmar, M. L. (2005). "Some Results from Dittmar Associates' Market Study for Space Exploration", *Proceedings of the First AIAA Space Exploration Conference*, AIAA, Washington, D.C., 2005.