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## Identifying Sociological Factors for the Success of Space Exploration

C. A. Lundquist<sup>a\*</sup>, D. Tarter<sup>b</sup>, A. Coleman<sup>c</sup><sup>a</sup>Research Institute, University of Alabama Huntsville, Huntsville, AL 35899<sup>b</sup>Professor of Sociology retired, University of Alabama Huntsville, Huntsville, AL 35899<sup>c</sup>Archives and Special Collections, UAH Library, Huntsville, AL 35899

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### Abstract

Astrosociology factors relevant to success of future space exploration may best be identified through studies of sociological circumstances of past successful explorations, such as the Apollo-Lunar Missions. These studies benefit from access to primary records of the past programs. The Archives and Special Collections Division of the Salmon Library at the University of Alabama Huntsville (UAH) houses large collections of material from the early periods of the space age. The Huntsville campus of the University of Alabama System had its birth in the mid-1950s at the time when the von Braun rocket team was relocated from Texas to Huntsville. The University, the City of Huntsville and the US Government rocket organizations developed in parallel over subsequent years. As a result, the University has a significant space heritage and focus. This is true not only for the engineering and science disciplines, but also for the social sciences. The life of the University spans the period when Huntsville government and industrial organizations were responsible for producing the rocket vehicles to first take mankind to the Moon. That endeavor was surely as significant sociologically as technologically. In the 1980s, Donald E. Tarter, conducted a series of video interviews with some leading members of the original von Braun team. Although the interviews ranged over many engineering subjects, they also recorded personal features of people involved in the Apollo lunar exploration program and the interactions between these people. Such knowledge was of course an objective. These interviews are now in the collections of the UAH Library Archives, along with extensive documentation from the same period. Under sponsorship of the Archives and the NASA-Marshall Retiree Association, the interview series was restarted in 2006 to obtain comparable oral-history interviews with more than fifty US born members of the rocket team from the 1960s. Again these video interviews are rich with insights into the people involved in the Apollo lunar exploration program. A common thought in the original and recent interviews is that the 1960s rocket team was a unique assembly of people with leadership and modes of operation that has not been reproduced since. If mankind is again going to the Moon, Mars, an asteroid or elsewhere in the solar system, a similar assembly of people and sociological conditions may well be required.

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\* Corresponding author. Tel.: +1-256-824-2684; fax: +1-256-824-6848.  
E-mail address: [lundquc@uah.edu](mailto:lundquc@uah.edu).

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## 1. Introduction

For successful execution of future human space explorations, it is important to identify and understand the sociological factors that contributed significantly to the success of past space explorations. These factors may best be identified through studies of sociological circumstances of past successful explorations. At this time, the Apollo-Lunar Missions are the only expeditions that have taken humans to another body in the solar system. Thus the Apollo Program is a prime subject for an astrosociological study. Such a study benefits from access to primary archival records.

The Space Archives at the University of Alabama Huntsville have diverse archival records of the Apollo Program. These Space Archives are a manifestation of a space emphasis at the University. In fact, the University can be characterized as a product of the U.S. space program. The Huntsville campus of the University of Alabama System had its birth in the mid-1950s at the time when the von Braun rocket team was relocated from Texas to Huntsville. The University, the City of Huntsville and the US Government rocket organizations developed in parallel over subsequent years [1]. As a result, the University has a significant space heritage and focus. This is true not only for the engineering and science disciplines, but also for the social sciences.

As the next section will elaborate, the University Archives became a repository for material from the beginning through maturation of the space era. But in particular, the life of the University spans the period when Huntsville government and industrial organizations were responsible for producing the Saturn rocket vehicles to first take mankind to the Moon.

Some of the most valuable records with sociological implications are the video interviews of many individuals who were active participants in the Apollo-Lunar Missions. As following sections will explain, these interviews were made at UAH in two stages. The first set was made in the mid-1980s with several members of the original rocket team that came to the United States with Wernher von Braun. The second set, produced in the 2000s, has interviews with more than 50 US born individuals who were members of the rocket team in the 1960s. Besides these video records, the Archives Department has extensive collections of printed documents pertinent to space activities.

Of course times change, and today's life is different from life in the 1960's. A very significant difference is the overwhelming evolution of digital, online, electronic handling of information of all kinds. The Archives staff at UAH recognizes this fact and has sought to make its space collections increasingly accessible online [2].

## 2. The Space Archives at UAH

The Space Archives at UAH is physically housed in the M. Louis Salmon Library, and electronically, on the Library's webpage under Digital Collections. The Collections continue to grow, especially as NASA employees retire and donate research materials. The Space Collections began about the same time that UAH became an autonomous campus with its own president in 1969. Actually, the Saturn V Collection predates the autonomous status by a few months, having been initiated as a NASA project history in 1968 [3].

The Saturn V Collection is a unique collection of documents that was organized to support the preparation of the book entitled *Stages to Saturn* [4]. This technological history of the Apollo/Saturn launch vehicles was published by NASA in 1980 as one of a series of special publications providing

NASA Project Histories. The Saturn History Project was initiated by the NASA Marshall Space Flight Center in Huntsville, Alabama in 1968 and a contract (NASA contract number NAS8-21321) was made with the University of Alabama Research Institute to support this endeavor. Approximately 1600 documents and many oral interviews were collected about Saturn V to support the writing of the book *Stages to Saturn* by author Roger Bilstein. Currently, over 900 of these documents have been digitized and are available on the Digital Archives shared by the US Space and Rocket Center on the UAH Library webpage.

Another collection that was instrumental in serving as a building block for the initial Space Archives Collections is the Willy Ley Collection. In 1969, the Willy Ley Collection was pursued by both UAH and the Smithsonian Institution. An agreement was reached, and the Willy Ley Collection at UAH consists of over 5,000 books and journals, while the Smithsonian holds the personal papers of Ley. Willy Ley [1906-1969] had amassed an amazing collection of books on every scientific subject, especially in the realm of rocketry and space travel. A native of Berlin, he studied at the University of Berlin and at the University of Konigsburg, specializing in paleontology, astronomy, and physics [5]. Ley never lived in Huntsville, AL but worked with Wernher von Braun and Walt Disney to promote the ideas of space travel to the American public. Ley was interviewed by Mike Wallace on *Night Beat* in 1957, and this recorded interview is in the collection.

One of the later collections is the Konrad Dannenberg Collection, donated by the family of Dannenberg after his death in 2009. Dannenberg was one of the original German rocket scientists. The collection consists of photographs, technical documents, biographies of many of the Germans who arrived in Huntsville AL in 1950. Dannenberg was a good speaker, and was active in the programs at the US Space and Rocket Center. He enjoyed interacting with space enthusiasts of all ages, and never missed a chance to promote the Space Archives. He frequently brought visitors to the Archives for visits, or even interviews. Dannenberg also participated in the interviews, both early and late.

### 3. Early Interviews, Documents And Implications

The "Peenemunde Old Timers," was the name collectively adopted by the members of the von Braun rocket team as they moved into retirement in the 1980's. Von Braun himself died in 1977. A majority of the original members remained in Huntsville but their numbers had been thinned by death and movement elsewhere,

In the 1980s, Donald Tarter, with his long-time friend and associate, Konrad Dannenberg, himself a member of the old timers, decided that the time was right to collect remaining first-hand memories from the original team. They obtained a grant and began trying to schedule interviews with approximately two dozen team members. In the end, 13 participants were interviewed, producing 13 hours of video recollections [6].

Many of the insights provided in this paper came from those 13 interviews. The original intent was to gather much more information on the von Braun team member's evaluations of the social, ethical, and moral considerations involve in their work, but the interviewees said little directly on these topics. The reluctance to discuss such topics was aggravated by the contemporary war-crimes allegations brought against one of their members, Dr. Arthur Rudolph.

The objective of Tarter's study was a sociological comparison of two great and memorable scientific and technological teams; the German Peenemuende rocket team under the direction of Dr. Wernher von Braun, and the American atomic bomb team under the direction of Dr. J. Robert Oppenheimer. Both were motivated by World War II.

In his concluding section, written in 1990, Tarter observes that the projects at both Peenemuende and Los Alamos were the product of peculiar and seemingly pathological forces at their time. Each in its own way has had to live with its deeds, endure public suspicions, and bear the judgments of history.

The cold war circumstances of the Apollo Program were different, and its execution and accomplishments largely enjoyed a favorable evaluation by society. A nearly contemporary exposition of

the operations leading to the Lunar exploration successes was published by Ordway and Seamans [7]. In their abstract, they assert that “Indeed the effort [Apollo] has been widely proclaimed as a management triumph as much as an engineering and scientific one.” It would probably be fair to substitute the more inclusive term ‘sociological’ for ‘management’ in this summary statement.

In a subsequent section, Ordway and Seamans [7] conclude that “Certainly, a major factor in Apollo’s success was the generally strong support enjoyed from the beginning of the program right through to its completion. More than any other effort in US peacetime history, the lunar landings illustrated the value of such support – which could accurately be described as a mandate – and the degree it could be generated when public interest was aroused.”

In a later section they state that “The management of Apollo relied heavily on effective communications and the rapid generation of technical and management information. ... Government and industrial experience had long ago demonstrated that a large percentage of management problems is due to breakdown in the rapid flow of information. In light of this, one of the first activities undertaken in the Apollo program was to structure NASA’s manned space flight development organization so as to give each major element a single clear line of reporting and authority.”

Ordway and Seamans [7] observe further that “NASA emphasized and reemphasized that all participants were members of a single national team and that our mandate could not be achieved if our problems and failures were kept hidden. It was felt that if difficulties were out in the open there would be a strong incentive to overcome them.”

In their final sections, Ordway and Seamans [7] discuss other large technological endeavors that failed because the endeavors were missing one of the factors identified for success.

#### **4. Later Interviews, Documents and Implications**

In 2002, a letter from UAH to the NASA-MSFC Retiree Association [MRA] reminded the retirees that UAH had a Space Archives that welcomed contributions of documents from individuals who had private collections they wished to see preserved and make available for historic purposes. At that time, many MSFC ‘old-timers’ had retired or were retiring. The UAH opportunity was accepted by many of them, and a surge of document contributions resulted.

Collaboration between the UAH Archives and the Retiree Association entered a new phase in 2006, when a second series of oral history interviews was initiated. Most of the interviewees were US-born, former NASA employees who were involved in the early space programs, particularly the Apollo-Lunar Missions. Often they were individuals who had also donated their historic documents to the Archives. The interviews were implemented by a joint UAH-MRA team: Anne Coleman, Robert Middleton and Charles Lundquist.

On October 25-27, 2010, at UAHuntsville, the 3<sup>rd</sup> Wernher von Braun Memorial Symposium addressed “The 21<sup>st</sup> Century Approaches to the Use and Development of Space”. Space policy was its dominant theme, but a panel in one session discussed the “Outlook for the Aerospace Industrial Base”. The last panel speaker was Frank L. Culbertson Jr., a former astronaut and International Space Station commander, now Senior Vice President of Advanced Programs at Orbital Sciences Corporation [8]. He stated what seemed to be a consensus for what is required for successful manned space exploration: strong leadership up and down the organization; effective communication; and clarity of purpose.

#### **5. Current Assessments**

By 2010, the interviews and documents in the UAH Archives constitute a very representative sample of the people, activities and interactions in the early space era. In particular, these records provide a rich source of insight into the astrosociology of the Apollo-Lunar Missions

The first important observation that arises from the interviews and documents is the pervasive feeling

of a coherent team. The Apollo-Saturn rocket vehicle team had many layers, from a cadre of close associates of von Braun to a far-flung array of industrial contractors. The feeling was prevalent among virtually all that they were essential members of a massive dedicated team.

The team concept was systematically encouraged by von Braun and a long chain of managers, above and below MSFC. Von Braun's attitude is well described by Frederick I. Ordway III in an Archives document [9]. While Ordway was working on the book, *The Rocket Team*, he had a discussion with von Braun, which Ordway relates:

"I recall vividly von Braun's insistence in our emphasizing the team, which we did, as well as assuring me and others that he had no intention of writing an autobiography or collaborating on an authorized biography. It was team, team, team, the "magnificent team" characterized, he would stress, by "...enthusiasm, professionalism, skill, imagination, a sense of perfectionism, and dedication to rocketry and space exploration."

Hence, a biography of the 'Rocket Team' [10] was produced and published years before a biography of von Braun [11].

The first astrosociology factor for the Apollo success is the achievement of a pervasive dedicated team spirit among all the involved members.

A first corollary of this team factor was clear delegation and recognition of responsibility for pieces of the overall project. Individual team members knew what items, big or small, were their responsibility and on what schedule. No one wanted to be a failing link in the endeavor, so all were motivated to devote every effort to assure their piece met requirements.

A second corollary of the team factor is uninhibited, facile communications up and down management channels. In MSFC it was widely understood that if anyone, anywhere in the organization, had a concern about a hardware item or some operational matter, that individual must bring his concern to the attention of management. It was recognized that few concerns would prove to be serious, but no one was criticized for raising a concern, no matter what was the outcome. However, having a concern and not raising it was a serious offense. Any problem not resolved by lower management reached von Braun via the weekly notes [12]. They were then addressed and appropriate action taken.

This policy surely was a significant factor in the remarkable success record of the Saturn rockets. The policy was also a contributor to the team concept. Everyone had responsibility to recognize and raise concerns that would then be considered by management.

A second obvious realization from the Archives records is that the Apollo-Lunar Missions had unequivocal support at all levels of the U.S. Government. The justified funding to accomplish the Lunar Missions was provided. The reasons for this unanimity of purpose were largely political, but lunar exploration also had recognized scientific and technological goals.

The unequivocal support for the Apollo-Lunar Missions clearly helped promote the team concept. It is hard to assess what degree of team spirit could have been maintained without a national commitment. It seems appropriate to conclude that major human space explorations can proceed to fulfillment only with a recognized national commitment.

A third conclusion from the Archives records is the importance of recognized, competent leadership, particularly at the top of the program. The Saturn rocket vehicle program that provided the essential transportation for lunar exploration had Wernher von Braun as its leader. All interviewees, from German or U.S. origins, agree that von Braun had remarkable leadership talent. This talent had many dimensions or aspects. In an historical book assembled by the NASA-MSFC Retiree Association, Ernst Stuhlinger lists the qualities of von Braun's leadership [13].

- His superior intelligence, supported by a phenomenal memory;
- His almost unlimited interest in all kinds of human activities;
- His capability to define the technical projects he wanted to bring to life very exactly, and then to work tirelessly until they were accomplished;
- His almost magic ability to form a team, to make it grow and to keep it together, even for years after his death;

- His way of conducting joint technical discussions so that all participants could understand what the problem was, and of continuing such discussions until a reasonable solution had been found;
- His ability to make every one of his team feel proud and privileged to work for him;
- His intent to make sure that a counterpart in a technical dispute did not feel to be the loser, but just the second winner;
- His gift of feeling equally at ease whether he conversed with his driver or with the President of the United States;
- His proverbial carefulness as a practicing engineer;
- His way of giving presentations to Congress that always had standing room only attendance; and
- His fabulous success as an ardent communicator and public relations man for the idea of space exploration.”

Not many leaders in any discipline have demonstrated such attributes, and few have led an activity as successful as the Apollo-Lunar Missions. Many of the attributes listed ‘rubbed off’ on von Braun’s unit directors, or at least most unit directors tried to emulate the attributes.

## 6. Conclusions

The important factors for space exploration success discussed above are human or sociological in nature. It should not be a surprise that the essential factors gleaned from the UAH interviews and Archives have the same conclusions as other published analyses. Of course the engineering and technology must be proper. Fortunately, most of the technical aspects of a program, such as the Apollo-Lunar Exploration, can be, and were, confirmed and qualified by vigorous test programs. The technological features of future space explorations should also be amenable to test demonstrations. That leaves the astrosociology features of future human space exploration as the most difficult to put in place.

Perhaps the most unfathomable factor for success of major space activity is unequivocal government support. Identifying and employing exceptional leaders is also a very challenging matter, but perhaps the needed exceptional leaders will be the very individuals who recognize and advocate specific actions to address some major task. If a selected leader initially fails to recognize the need for open communications and team spirit, wise advisors can help him adopt these qualities.

It is hard to predict any manned space exploration that could command continuing, nonpartisan support. Probably the discovery of an asteroid on an orbit leading to Earth impact would generate unequivocal support for actions to prevent or mitigate its effect. Such actions might or might not involve manned operations in space.

Maybe discovery of even primitive life of some strange form on some other solar system body could generate enough excitement to get wide-spread support for appropriate investigations. Such an exciting objective might have a reasonable chance of motivating a team spirit if effectively promoted by facile management. Other circumstances enjoying necessary support are likely to be similarly unpredictable. One can only hope that a World War III will not be the motivating circumstance.

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