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## Paper Session III-D - Trials, Transformations, and Triumphs: The Space Program's Past, Present, and Future Impact on Society

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# **Trials, Transformations, and Triumphs:**

## **The Space Program's Past, Present, and Future Impact on Society.**

Presented by Melissa Kullik.

### **Abstract.**

Human nature is governed by the need to explore, discover, and surpass. The space program — humanity's greatest exploration — has given us unimagined benefits technologically, scientifically, and theoretically, both in terms of education as well as practical application. Historically, it can be shown that the study of space has had an impact on many fields such as civilian and military engineering, education, astronomy, and international politics, all of which have improved the quality of life. Mankind is now poised on the brink of a new discovery, a new revolution in thought and theory, which could bring myriads of benefits to all of society. This peak can only be achieved through the continued exploration and study of space, not only for the physical benefits, but also for our psychological well-being. Despite the financial and safety concerns of the public, the government, and those individuals directly involved in the program, space exploration must continue, or else those undiscovered benefits may well remain hidden behind the stars.

### **The Challenge.**

Ever since the dawn of time, Mankind has fostered an unquenchable thirst for exploration and discovery. Whether it be crossing the elusive depths of untamable oceans to seek the unknown continents beyond, probing the inner realms of the most minute components of life to reveal their mysteries, or soaring into the heavens above to touch the soils of another world, Mankind has never shied from the challenges that nature presents. Always, our explorations have been coupled with discoveries that profoundly change our perspective of our place in the universe, and those changes have been vehemently resisted. Yet still we persevere, continuing our quest for further knowledge and greater understanding, not only for the practical aspects of our lives, but for the ultimate meaning of life itself.

Mankind's expansion into the realms of space has been no exception to the daunting challenge of discovery. The Copernican Revolution, which sponsored the idea — contrary to the popular beliefs — that the Earth was not the center of creation, was only the first fundamental change in our perceptions of the universe around us and our place in it. In the past few decades, however, our challenge has not diminished, but been ignored. Few people now advocate the continued exploration of space, in comparison to the massive public support during the *Apollo* program, largely due to the fiscal concerns of society. The conquest of space, however, has given us so much in terms of technology, knowledge, and even hope, that it should not be disbanded nor decreased when we have barely begun to scratch the surface of its potential, and our own.

### **The Technology.**

One of the most prominent results of the space program does not originate from the actual exploration beyond our world, but rather from the preparations we make for our voyage to the stars. The technology generated by Mankind's drive to space has greatly influenced and benefited the welfare of society, both in terms of material products and more indirectly by its application to myriads of other influential fields.

The material products that have resulted from the space program cover an immensely diverse range of categories and applications. In fact, there have been more than 30,000 such

“spinoffs” since the beginning of the program. Because of the need for lightweight materials that were both durable and strong, plastics have been developed and are continually refined, and today they can be seen in an infinite number of products, far too numerous to mention even a sample by name. The need for heat resistant materials, necessary if our manned spacecraft were to withstand the grueling heat of reentry, has produced such by-products as more advanced fire-proof materials — paints and foams, for example — and more effective fire-fighting methods, used not only on the launchpad but also in communities across the nation. Techniques have been developed that were intended to facilitate extra-vehicular activities in space that have now been adapted to terrestrial use in the forms of grooved highways and surfaces that provide better traction in adverse weather conditions.

All of these material advances, however, have been dwarfed by one result of the space program which has touched nearly all of humanity — the development of computers. From the video games of preschoolers, to the pocket calculators of junior high, to the personal computers available to high school students and beyond, computers affect all ages, races, ethnicities, and professions. The miniaturization necessary to carry these computers into space has made them less expensive to produce, and more convenient for the general public to own and to use. Not only have computers affected society as a product, but also as a business. Economically, computers have had a vast impact on the job market, creating new careers in such fields as computer science, programming, and development, as well as revitalizing other scientific fields such as physics and astronomy by facilitating the mathematical calculations and precision necessary for greater achievement.

The crude material gains of society, however, are not the only positive impacts of the space program that can be noted. These technological gains can be applied to a variety of other sciences, each of which affects society in various ways. For instance, the medical field has benefited greatly from research intended for the space program. Lightweight, durable power sources developed for use with both the manned and unmanned space missions have been adapted to create pacemakers, devices utilized to regulate faulty heartbeats. The miniaturization techniques induced by the space program have prompted similar techniques to discover the inner machinations of the human body, and such advances as laser surgery, fiber optics, and a variety of monitoring devices for heartbeat, respiration, and even brain activity have saved countless lives, both young and old.

The medical field is not the only scientific field that has benefited immensely from research initially intended for the space program. The communications field has expanded exponentially in recent decades, in ways which would not be possible if not for the ingenuity of the space program. Communications satellites, which would, only a few generations earlier, have been dismissed as fantasy, now circle the globe and allow nearly instantaneous communication between different countries and even remote continents. Telephone services have improved immensely — both by an increase in quality and a decrease in expense — due to the development of fiber optics. All of these advances have drawn countries and continents closer together, in ways never before imagined — uniting society on Earth, reminiscent of the fact that there are no political boundaries in space.

The space program has proven to be beneficial to society in a multitude of ways, even if one only considers the crude technology that has been created. Not only have the products resulting from space research benefited society as a whole directly, but their application to various other fields of research has augmented the welfare of humanity as well. Mankind, however, has only begun to discover its technological potential, and multitudes of other benefits could be discovered by the continuation of the space program — possibly not only from the technology itself, but also from the worlds which it will lead us to explore.

## **The Knowledge.**

Along with the development of more sophisticated technology comes the potential for greater knowledge and understanding, not only of the outer depths of the cosmos, but of our own, cosmically insignificant world. Historically, the development of technology utilized for the

study of space has greatly increased our understanding, as well as facilitated our interaction with our own world. For instance, Galileo's invention of the telescope transformed the work not only of astronomers, but also that of navigators. Not only was that precision instrument trained on the stars and heavens, but also on the distant coasts and geographical features of the Earth, which allowed for easier navigation and exploration of our own planet while our bodies still remained Earth-bound, though our curiosity was already reaching beyond our world.

Today's space technology and study of the cosmos has vastly more influential effects on the knowledge we acquire about our world. By studying the turbulent atmospheric conditions of Mars and Venus, we have learned vast amounts of information pertaining to chemistry, erosion, and the greenhouse effect, all of which we have been able to apply to achieve a better understanding of Earth and our influence on it. In an even more basic sense, our space technology has contributed directly to our knowledge of our planet. Satellites, hundreds of miles above the Earth, are now able to probe deep into the depths of our oceans just as they are able to probe far into the universe, and both directions have provided us with information of inestimable value — the former relative to our own world, the latter relative to the universe. Those same satellites have proven invaluable in weather forecasting, and people around the world owe their lives to our ability to track and predict the paths of treacherous storms.

Our knowledge of the universe has expanded not only in the practical, concrete sense from the advances made by the space program, but also in a theoretical, abstract perspective. Modern-day physicists have been able to reconstruct time itself from evidence gathered by our celestial equipment, probing back as far as a fraction of a fraction of a fraction of a second after the creation of the universe, space, and time as we perceive it. With the mathematical relationships that have been conceived due to the current evidence and measurements from our space equipment, those same physicists can even predict the motions of the cosmos infinitely into the future. Theories have been developed to explain minute irregularities in previous theories, all to accommodate the new information acquired daily in our study of the space beyond our world, beyond our star system, and currently, beyond our reach.

## **The People.**

Not only have our scientific views been dramatically altered by the accomplishments of the space program, but our political views and international cooperation have evolved to meet the challenge of exploring beyond our world. The space program began with suspicion and conflict, as the two superpowers of the world competed for the honor and distinction of being "first": first to launch a man into space, first to have a man orbit the Earth, first to land a man on the moon. The Space Race was simply a manifestation of the Cold War which bound together those two nations against their ideological foes — never before nor since has the American public been so strongly united toward a common scientific goal.

In the past decade, the Soviet Union has ceased to exist, therefore eliminating one of those superpowers. The space program, however, has proven that it is not dependent on political rivalries in order to expand and continue its amazing contributions to society. Rather, the program has embraced international aims, even coupling with its former adversary in the administration of the space station *MIR* for the benefit of scientific research. Plans are under development for the construction of an international space station, a research hub that would allow scientists and astronomers from many nations to conduct unprecedented research. Clearly, the space program that was born under amidst concealed hostilities has opened up a new era of international cooperation, one that may, in the future, preside over a more peaceful and cooperative world.

## **The Mind.**

Such dramatic changes in the perceptions that we hold of science — like the Copernican Revolution of ages past — have never ceased to propagate corresponding dramatic changes in our philosophy, our perception of our place@ in the universe. Never before has Mankind shied

from the challenges that are presented, nor have we hidden from the truth — or what we perceive as such. No matter how outlandish or outrageous these new ideas, new perceptions, and even new realities seem, if they do in fact fit with our perception of our existence, then they are inevitably accepted, even if only as mathematical tools, manipulated solely for their instrumental value. In truth, there are many violent debates about the nature of reality as being either that which we can calculate with mathematical, irrefutable laws, that which we can perceive with our observations, both, or neither.

Mankind is ready for a new perspective. Our current perceptions of the cosmos can no longer account for the data we are receiving from the equipment we have developed for our study of the universe. Yet what new reality shall we forge from the fires of space discovery? Many aspects of our current perspective may come to be challenged, one of which, for example, may be the constancy of the speed of light. Perhaps the speed of light does not represent a finite end to the speed of the cosmos, but only an end to itself when viewed from another frame of reference. Other dimensions of space and time may be discovered which uncover the possibility that what we call space is not, in fact, a vacuum — that it is instead filled with some medium of energy, or some other substance beyond our conceptions, that interacts with the unique properties of light to generate friction, and impose a terminal velocity on its speed. Albeit that speed in and of itself is tremendous, bordering on the edge of fantasy for our perceptions, yet if there is one thing that nature has consistently revealed it is that the only limit is that of the human mind. Yet how are we to discover this new medium, or any other new perception of reality, if we continually shackle ourselves to this one planet in a universe of infinite others? To further our knowledge, our understanding, and our philosophy, we must press onward, upward, until we reach those elusive stars by ways in which our valiant predecessors could only dream.

## **The Concerns.**

Why aren't we going? With such revolutionary discovery at our fingertips, just barely beyond our reach, why haven't we taken the next small step to go beyond what we have already achieved? Critics generally cite two distinct arguments to either decelerate or cease the program altogether: money and safety.

Granted, financially, the conquest of space is one of the most lucratively expensive exploits ever attempted. One must consider, however, the financial potential that lies in outer space, potential that we could harness to lessen the cost not only of the program itself, but also of multitudes of other resource-demanding exploits here on Earth. The chemical compositions of the worlds within our solar system, not to mention the solar energy potential of our sun, could easily provide nearly infinite energy sources several times in excess of what we are currently capable of producing with our Terran resources and facilities. What other benefits that may lie only in the stars — benefits to astronomy, medicine, chemistry, physics — cannot possibly be predicted, and yet, they must be out there. It is the gravest of conceits for humanity to presume to know everything about the universe, and it is the gravest of errors for humanity to stop trying to learn.

The second prominent concern that is voiced against the continuation of the space program is the precious value of human life, and the distinct possibility that it will be lost in such a pursuit. Once again, however, those that uphold this unenlightened opinion have failed to realize the potential of the universe: the potential for destruction. If we remain Earth-bound, we have doomed ourselves to destruction and certain annihilation. It is a statistical certainty that our sun will become a nova — an immense, exploding star that will bathe the planet Earth in its fiery breath and blacken it to nothing more than a smoldering cinder. Granted, this event is so far in the future as to be beyond our realm of comprehension and hence, of our immediate concern. But other concerns about the condition of the Earth have been raised: overpopulation, and the inability to produce adequate amounts of food if the population continues to grow at such alarming rates. The space program, however, is capable of researching methods of growing food hydroponically — without soil — and may one day even provide the basis for colonies on other worlds. As for the safety of such ventures, the space program itself is not a reckless

dash into the unknown — the greatest of security precautions, the most elaborate of emergency procedures, and the bravest of people are those that promote the program, and those brave and noble people are well informed about the dangers they face. Do they shy away from the challenge, the discovery, the uncertainty? No — nor should humanity. As the Astronaut Memorial at Kennedy Space Center, Florida, reads:

*whenever mankind has sought to conquer new frontiers, there have been those who have given their lives for the cause. This Astronauts' Memorial, dedicated May 9, 1991, is a tribute to American men and women who have made the ultimate sacrifice believing the conquest of space is worth the risk of life.*

To say now, after those men and women, believing so greatly in the future of space exploration, have given their lives to that pursuit, that it is too dangerous to risk further human life, would be the most malignant of insults that would taint that Aspirit of humanity@ to a dull, insensitive, ignorant ghost. We must press onward, and continue the trek to the stars that has begun in blood, to honor those individuals whose spirits have reached the heavens before us.

A final note that must be made on the safety of the space program concerns the advancements that those precautions have accrued over the past decades. Now, more than ever, the controllers both at the launch site and at Mission Control safeguard the lives of the astronauts as if they were their own, supported by multitudes of sophisticated equipment — created by the program itself — and in touch with the most advanced medical facilities in existence. While the inherent risks of space travel and exploration can never be nullified, they can be minimized.

## **The Hope.**

The nature of humanity is to explore, discover, and progress. Since crawling out of the prehistoric mire to gaze upon a single, elusive spark, Mankind has since turned its ever wandering gaze to the incandescent fireballs of the heavens. Curiosity is the driving force behind our insatiable urge to continually surmount what we have achieved in the past, yet that curiosity can never be satisfied. Again and again, we have overcome obstacles and prejudices to reshape our reality, both scientifically and philosophically. We must fight to overthrow the concerns that have slowed us presently. It is not in human nature to stagnate in the past; we must blend into the future. Perhaps the future is in the discovery of the past, the unraveling of the secrets held by that micro-fraction of a second of time since Creation, or perhaps it is in the exploration of the infinite distance that awaits. No matter what we decide, it is clear that we have only one path to take — a path filled with tremendous hardship and the shedding of cherished scientific and philosophical beliefs, but a path filled with knowledge, discovery, and new realities, new perceptions, and new life — our own, and perhaps others that we never could have imagined. The nature of humanity is expansion, and the nature of reality is accommodation.

## **The Promise.**

More than thirty years have passed since President John F. Kennedy issued a challenge to the fledgling NASA — a challenge to “land a man on the moon and return him safely to the Earth.” Presidents have altered their concerns, our manned voyages to the moon have come and gone, and yet President Kennedy’s challenge is no less valid today than it was three decades ago. There are other worlds in our solar system to be explored, other mysteries to solve about this small corner of the universe that we call home, and many other corners that await our footsteps. Now, more than ever, we need to continue our path to the stars, and perhaps one day our descendants will thank us for the technologically advanced and peaceful society that we will have forged.

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