



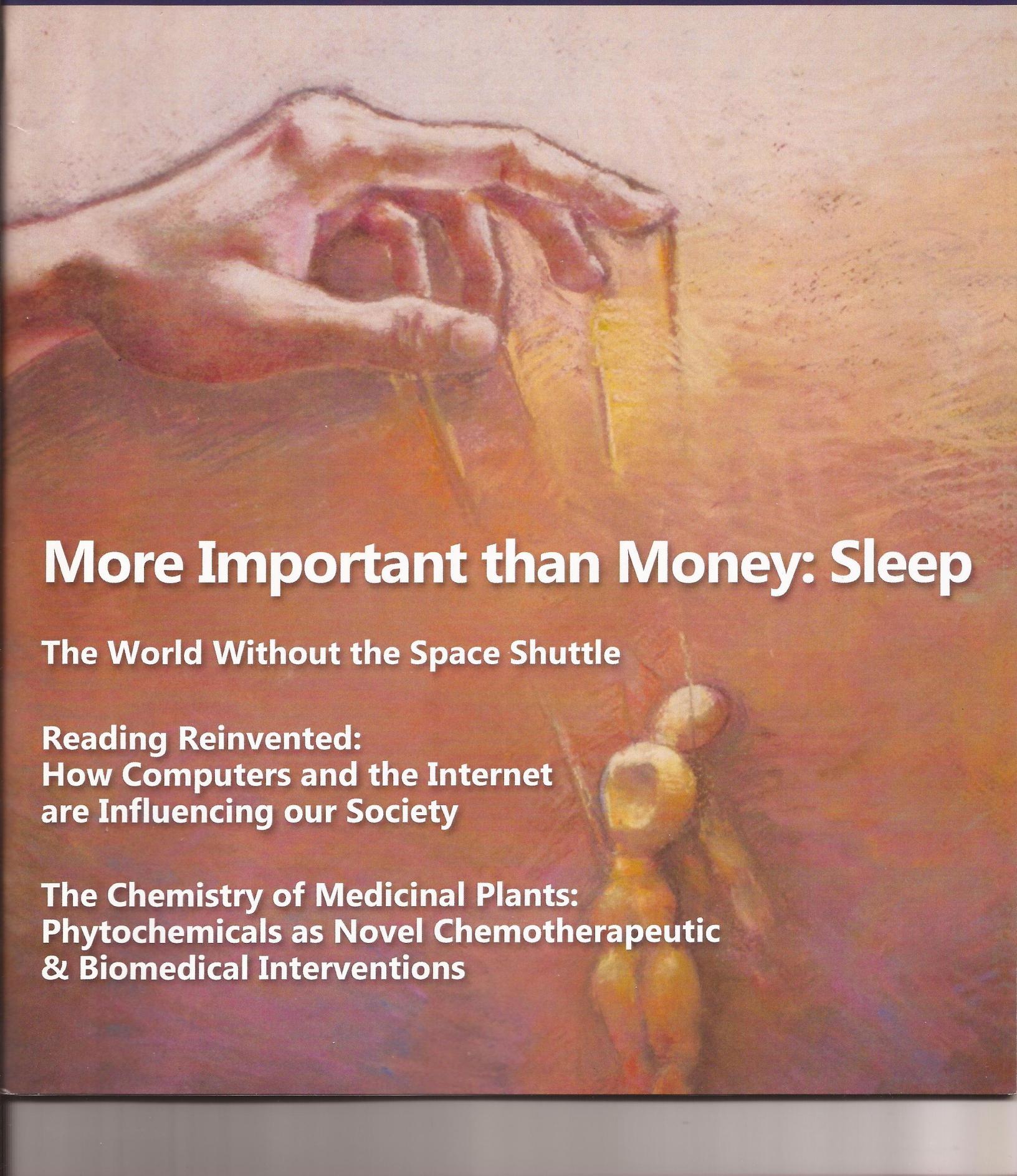
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More Important than Money: Sleep

The World Without the Space Shuttle

**Reading Reinvented:
How Computers and the Internet
are Influencing our Society**

**The Chemistry of Medicinal Plants:
Phytochemicals as Novel Chemotherapeutic
& Biomedical Interventions**

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The World Without the Space Shuttle

Michael Hammer

Then I saw the bright little ball, moving majestically across the narrow star field...[Sputnik] soared with what seemed to me inexorable and dangerous purpose, as if there were no power in the universe that could stop it...I couldn't believe it. I felt that if I stretched out enough, I could touch it" [1]. In his memoir *October Sky*, former NASA engineer Homer Hickam emphasizes how the Space Race and his amazement at the sight of Sputnik—the first satellite launched into space— influenced him to leave his coal-mining hometown for a life of rocketry and aerospace engineering. The Space Race between the United States and



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the Soviet Union did not just land a man on the moon, but also symbolized the political tension between the two countries. Ultimately, it sparked a scientific and technological revolution that asserted the United States' place as a world leader in technology and human spaceflight.

Technology from Human Spaceflight

When people think of the Space Shuttle, they think of the orbiter vehicle itself, the gigantic fuel tank and solid rocket boosters, and the magnificent sight of each liftoff from the Kennedy Space Center. Yet, the Space Shuttle is so much more than that. Sending humans into space and returning them to Earth alive is one of the most difficult projects humanity has

ever undertaken. It requires scientists and engineers to push the technological boundaries in unexpected ways in a wide variety of fields to be successful. As a result, the Space Shuttle program and the preceding Apollo program have influenced technology in our everyday lives.

For example, the Space Shuttle is an enormous, extremely heavy structure and requires special rocketry to be lifted off the ground. Thus, NASA created newer, more powerful fuel pumps to be able to assist in launching the shuttle off into space [2]. Dr. Michael DeBakey, a cardiac surgeon, studied the designs for these fuel pumps before he created the first artificial heart

pump—known as the Left Ventricular Assist Device. This device has the power to pump blood in the heart for up to a year, a feat that can keep patients alive should they need to wait for a donor [2]. Similarly, NASA has helped out firefighters with their jobs as well. In order to study the rocket fuel being dispersed from the Space Shuttle during liftoff, NASA created better infrared cameras called QWIPs (Quantum Well Infrared Photodetectors) [3]. Firefighters can also use these QWIPs to identify dangerous hot spots in brush-fires via satellite [4].

Furthermore when NASA was planning the first walk on the moon, they needed to provide their astronauts with clothing strong enough to withstand the typical 250°F temperatures during the lunar day. Firefighters wear clothing based on these liquid-cooled garments to keep themselves alive as they save other people's lives [2].

An Uncertain Future

Despite these technological advances, President Bush cancelled the Space Shuttle Program in 2004—effective in 2011—for safety concerns. Bush made the decision less than a year after the Columbia space shuttle disintegrated as it was re-entering Earth's atmosphere and killed its crew. Neither NASA, nor

the government wanted to risk another disaster [5]. Each of the five space shuttles that were a part of the program were either built in the early 1980s or followed a similar design, and they were long overdue for a safer, more efficient replacement. Bush expressed his intent to keep human spaceflight intact, saying, "The causes in which they [the Columbia astronauts] died will continue...our journey into space will go on" [6]. The government started the Constellation (CxP) program to create a new vehicle for human spaceflight to take over as soon as possible after the decommissioning of the space shuttle in 2011.

[The space program] is an investment in technology, jobs, international respect and geo-political leadership, and perhaps most importantly in the inspiration and education of our youth. Now is the time to be bold, innovative and wise in how we invest in the future of America

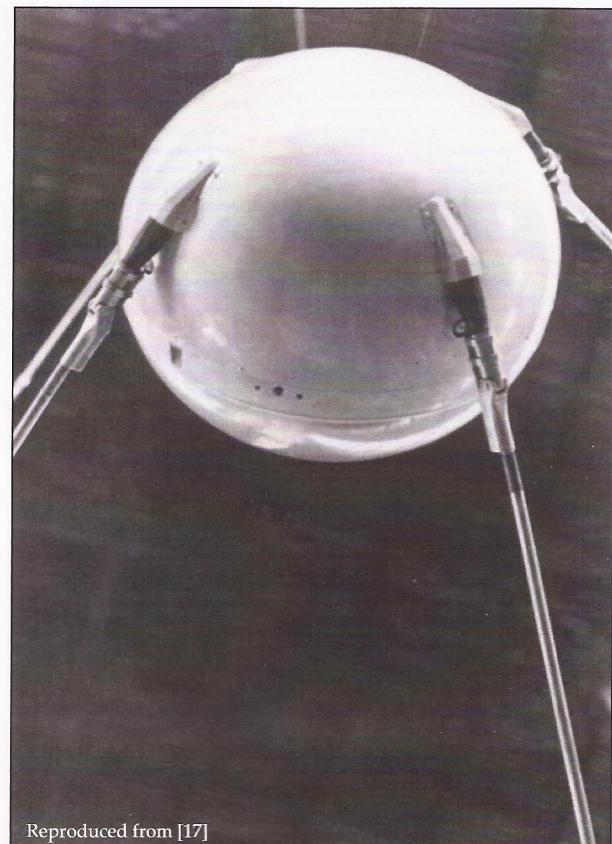
However in 2010, President Obama cancelled CxP not for safety reasons, but due to budget concerns and the program being behind schedule [7]. For at least the next five years, NASA will have no human spaceflight vehicle and no government program under which to operate [8]. The United States—the world leader in human spaceflight for decades—can only send their astronauts into space through the Russian Federal Space Agency at the cost of over \$50 million per seat [9]. During this time, the government will supply NASA with funding to build vehicles that are modified versions of those planned for CxP, but with no specific plans for how or whether the government will fund any launches using these vehicles. Budget should not be a cause for concern since NASA barely receives any money these days compared to when spaceflight began. In 1965, the government gave NASA 5.3% of the federal budget, half of which went to human spaceflight [10]. A few years later, man landed on the moon. In this decade, only 0.1% of the federal budget goes to human spaceflight. CxP was cancelled in part due to not having enough funds and in part due to being behind schedule. Yet if the government gave them more funding, they most likely would not have been behind schedule [7].

If the United States government does not wish to express the same leadership as they have in the past, they also have the option of letting the commercial space industry manage human spaceflight. This would entail making human spaceflight for profit and the government paying corporations for seats on their space vehicles, at a cost much less than the Russians would charge. However, former NASA administrator Mike

Griffin believes NASA should not be dependent on private industry, saying, "A real space program... should offer a stable market to be addressed by commercial providers, but it cannot be dependent upon such providers for strategic capabilities" [11]. The commercial space industry is currently responsible for sending satellites into space, but there is a big difference between sending a piece of machinery and sending a living, breathing human. Since this has never been done before, commercial launches might not be as cheap as the industry claims. Furthermore, the commercial industry would not have the same urgency or motivation as the government towards carrying out national missions on schedule [12]. As of now, they are not ready to take on the task.

Human Spaceflight's Influence on Education

NASA needs a high education level in this country for human spaceflight to be successful. Towards the beginning of the Space Race in 1957, the Soviet Union struck first by launching Sputnik into space. Desperate to win the race to the moon, the United States government passed the National Defense Education Act of 1958 to boost education in science. The act supplied science lab equipment to over 10,000 schools and provided money for loans to students who could not afford to pay for college. This increased high school students' readiness for college as well as the number of degrees in science and engineering fields [13]. Furthermore, the Office of Science and Technology Policy conducted a study on the Act and concluded that it definitively encouraged more students to



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become teachers at the college level after graduate school and ultimately increased the quality of teachers [13].



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Educator quality is a problem that still exists today. In 2000, only 55% of high school science teachers had a degree in the science field that they were teaching [14]. Meanwhile, most elementary school science teachers are only teaching science so their students can fulfill state requirements [14]. As of 2011, unemployment in the United States is close to 9%, yet there is still a need for people to fill science and en-

gineering jobs that is only expected to increase in the future. The National Defense Education Act was successful in 1958 by spending several hundred million dollars. As of 2007 due to budget cuts, NASA spends \$40 million on education and public outreach, far less than they did in the past [14]. These days, both human spaceflight and the need for scientists and engineers still exist as motivation to fund and advance science education in a situation similar to the Space Race. Human spaceflight serves not only as an inspiration for science, but also as motivation for NASA to sponsor programs for science education so that the United States can fill the jobs of our more technologically advanced world.

In 1965, President John F. Kennedy declared that, "We possess all the resources and all the talents necessary [to go to the Moon]. But the facts of the matter are that we have never made the national decisions or marshaled the national resources required for such leadership" [15]. He believed that the United States could land a man on the moon provided that the government assumes the proper leadership. Within five years, our country succeeded at that goal. The situation today is similar. NASA is working on constructing successor vehicles to the Space Shuttle, though due to a lack of consistent government leadership, these projects are still incomplete. As Gene Cernan, commander of Apollo 17, testified before Congress, "[The space program] is an investment in technology, jobs, international respect and geo-political leadership, and perhaps most importantly in the inspiration and education of our youth. Now is the time to be bold, innovative and wise in how we invest in the future of America" [11]. The government should take an interest in human spaceflight because it contributes to America's image, education, and technology—not just in our country, but in comparison to the rest of the world. The United States has been the world leader in space flight since the moon landing. The government has the choice of whether or not to uphold that status. ■

Michael Hammer is a freshman at Cornell University in the College of Arts and Science majoring in Astronomy.

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